DEC 15 1881

THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXXIV. No. 2. Whole No. 518. | NEW YORK, MONDAY, JANUARY 17, 1881 | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors.
G. WARREN DRESSER, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European Countries, $3 50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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[OFFICIAL NOTICE.]

New England Association of Gas Engineers.

The Annual Meeting of the Association will be held at Young's Hotel, Boston, on the 16th, 17th and 18th days of February next, commencing at 11 o'clock on Wednesday morning, Feb. 16th.

Members intending to propose to the Association the names of applicants for membership are requested to send them to the Secretary at least one day before the meeting. The Directors will meet, at the same place, on the evening of February 15th, at eight o'clock. Papers to be read should be forwarded to the Secretary in season to be presented by him to the Directors, at that meeting, for their approval.

GEO. B. NEAL,
Secretary.

BOSTON, Jan. 10, 1881.

RELATIVE PRICES OF GAS WHEN OF DIFFERENT ILLUMINATING POWERS

The answer to a question in our last issue as to what price 16 candle gas should be sold to make the cost to consumers the same as that of 21 candle gas is given by a correspondent in another column.

This answer makes the proper price to be in direct proportion to the quantity of light furnished, and is all right from that standpoint. But the trouble in this case is that gas companies, as a general rule, do not sell light but simply sell gas, which is measured as gas before combustion takes place. In fact, if the customer sees fit to allow his gas to escape, or to use it for any other purpose than for illumination, it is measured in exactly the same manner as if it had been used for lighting. Moreover the quantity of light obtainable from a given quantity of gas is so dependent upon the kind of burner used, the latter being in no way under the control of the gas maker, that it is very difficult to say what the light value of any gas is as used by the average consumer.

While we are fully aware of the standard ordinarily referred to in naming the candle power of a gas, still this is often quite different from what is ordinarily obtained by the consumer. Consequently, it would be rather a doubtful method of determining the value of gas to the consumer to rely entirely upon the illuminating power. Let us take an example. Ordinary Youghiogheny coal will easily yield 10,000 feet of 15 candle gas to the ton. If the cost of a ton of coal is five dollars, the cost of *coal alone* for 100,000 feet of gas would be as follows :

100,000 *Cubic Feet of Gas*, 15 *Candle Power.*

10 tons Youghiogheny coal @ $5		$50.00
Deduct 350 bushels coke @ 7c	$24.50	
" 10 gallons tar @ 10c	1.00	
" Ammonia water	20	
		$25.70
		$24.30

To make 20 candle gas would require 20 per cent. of cannel to bring up the illuminating power, and the cost for materials would be as follows for 100,000 cubic feet of 20 candle gas :

Two tons cannel at $10		$20.00
Eight " Youghiogheny @5		40.00
		$60.00
Deduct coke	$24.50	
" tar	1.00	
" ammoniacal liquor	20	
		$25.70
		$34.30

The cost for labor, condensation, purification, distribution and superintendence would not differ materially in the two cases, while taxes, etc., would be the same.

From this estimate, looking at the problem as a manufacturer of gas, it would appear that if a man could not afford to sell gas of 20 candle power at less than $3.33, and secure a fair profit, he could sell a 15 candle gas at about $2.36, instead of $2.50, as per answer on page 36.

But there is another element which comes in here that every manufacturer is well aware of. The larger the quantity made the smaller is the pro-

portion of fixed charges that each thousand feet has to bear ; and there is no question but that a lower price, judiciously established, will increase the amount of business, and, consequently, the amount of profits.

That good sixteen candle gas is the best and most economical for both the maker and the consumer cannot be doubted. It can be more perfectly consumed, with less trouble, and more light and better diffusive power can be obtained from it, in proportion to the quantity used, than from a 20 candle gas, simply from the fact that larger flames can be secured without smoking.

The true policy would be to sell the gas as low as possible, and pay ten per cent. on a reasonable capital, and be sure that the gas was uniformly a good, honest sixteen candle gas.

RESIDUAL PRODUCTS.

In our last issue we gave in full the lecture of Mr. Geo. Shepard Page, before the American Gas Light Association at Chicago, upon the subject of the value of residuals. The facts there stated certainly ought to be enough to arouse the managers of works to the importance of looking into this matter in a most thorough and practical manner.

We are aware that aggregates of small amounts sometimes show very largely, and that much labor, expense, and some disappointing experiments have to be endured before the totals given by Mr. Page could be realized in this country ; but as long as the possibility exists efforts should not be relaxed to discover a practical way of obtaining at least a large portion of the benefits that may be derived from the working up more perfectly the bye-products of the gas industry.

In this issue we give two papers read before societies in England and Scotland upon this same subject, with the discussions thereon, which contain many valuable statements as to results actually obtained by numbers of smaller works, as well as an account of the different processes used. These facts are valuable contributions to the literature of the subject, and show, in every case, a clear profit to the companies. As the price of gas is constantly expected to decline, the reduction in receipts for gas must be made up by increased revenue from residual products.

Paw Paw's Legend

And Paw-kee-wis told them stories—
Stories that were not all fiction ;
Told them of his own half brother,
Gas O Meter*—the great liar,
He whose name would scare the boldest,
He who made the strong man tremble :
He who could deceive the wisest,
He whose ways were past all knowledge
He the most consummate villain,
He the everlasting lyre ;
For he sang in every wigwam,
And his voice was low and soothing,
And he lulled all their suspicions—
Then he came down like a wind storm,
Charging them unheard of prices—
Prices that were simply 'normous.
Charged them ten times what he should have—
Charged for time he had been singing ;
Till at last they had him banished—
Banished with his tongues of fire *
To the land of Hocus-Pocus,
"To the land of the Hereafter."

IRA JOYCE.

* The irregularity of the verse is caused by introducing gas into the meter.—*Norristown Herald.*

Lights and Lighting.

The importance of good light, to enable work to be done after dark, is very great, and during the long evenings and when the hours of night encroach upon those of the working day, shops where orders are pressing feel the importance of some method of practical illumination. The first result of poor light is that the work is imperfectly done. The workman is not able to judge of the quality of what he is doing, and so the character of the product falls off, even though he may do his best. The quantity of work produced is also diminished, owing in part to the difficulty of seeing, and in part to the discomforts which are always entailed by an attempt to do anything by an imperfect light. There is always a wear of eyesight, too, which, though it may not be noticed at the moment, contributes to the weariness of the labor. A good light is a necessity in almost every manufacturing operation that can be carried on upon a large or small scale. In many lines, indeed, so important is this that the length of the working day in winter is always determined by the hours of daylight, and always ends before artificial light is needed.

In the great cities and most of our manufacturing towns there are at least three methods of artificial illumination which are available for work on a large scale. First in order of intensity is the electric light ; second, gas ; and last, oil, the latter, with the burners now available, having least power. The electric light, when it can be employed even under ordinary conditions, is very cheap, its cost being practically nominal. When an establishment has power available at night, the amount needed to drive the electric machine is so small that no ordinary establishment would ever miss the quantity needed for the largest light. With the present price for coal, a horse power can hardly be estimated to cost in a large engine more than a cent per hour, and all the other expenses will not more than double that figure. The consumption of carbons is not large, and with an outside estimate for power the total cost of a light of 1000 candle power for six hours would not be more than 48 to 50 cents. To this, if we calculate interest on the plant, we should perhaps add 15 or 16 cents, making a total of about 65 cents for six hours.

The electric light appears to be applicable in all places where power is used and where an abundant and intense light is needed. There are drawbacks, however, to its use, and these are somewhat serious. The light given is not a pure white ; it has a strong tinge of red and blue, and is notably wanting in the yellow. This makes the blues and reds, as well as all shades of green, unnaturally brilliant, while the yellows are exceedingly dull. This causes the peculiarly ghastly appearance which is so characteristic of the electric light. Another fault is that the source of light is practically a single point ; hence the shadows are as sharp as though the boundaries were marked with a knife. This prevents the possibility of soft shades, and makes every shadow of the deepest black. The tendency of this is to cause all objects to appear flat, even when they are round. Until these objections are removed the utility of the electric light will have well-defined limitations.

Wherever there are gas works an illumination, in some respects greater than that possible from the electric light, may be obtained by the use of large burners, and at a much less cost than is usually deemed possible. For example, by the use of a cluster of the largest burners manufactured by Bray, of London, 700 candle power can be obtained at a cost of about 25 cents per hour, or $1.50 for the six hours. This, it is true, is somewhat greater than that of the electric light, but no power is needed and no supervision required. At the office of the American agents of these burners we have seen much better results than these, but we have taken figures which are entirely within the results obtainable in practice. Gas has the advantage of throwing a diffused light, which is very valuable. The light, although not as white as that produced by the electric lamp, inclines to the yellow instead of toward the blue, and hence is not only more agreeable to the eye, but of more value to the workman.

In many of our country towns the only means for lighting is oil. Unfortunately, no large burners are in the market which are applicable to ordinary lamps. We believe that there are tubular lanterns which will give perhaps 48 candle power. The cost of running those burners for, say, six hours would amount to the expenditure of perhaps a pint of oil. These are much better than a number of small burners consuming the same quantity, and, so far as we know, are the best that can be had in the country. By them any shop may be well lighted, and work carried on with almost the same ease as with gas. The main object is to get light enough

In all cases a concentration of the sources of light, rather than a dispersion of them, is needed, except in the case of the electric light, when, for the sake of dispersing the dark shadows, it is sometimes necessary to divide the light and use two instead of one. A great loss of light, however, takes place when this is done, either with the electric, gas or oil lights. With oil and gas the burners should be kept as few in number and as close together as possible. One large burner is always better than two small ones, both on account of getting more from the same amount of oil or gas, and because one flame of double power or two flames close together are more effective than two similar flames separated by a considerable distance. The reason for this we cannot here discuss, but it is easily demonstrated.

Whatever light is used, let it be remembered that an abundance pays, not only in the amount of work and its quality, but in a thousand other ways. In the large cities, for example, an abundant light is made to pay for itself in ordinary shops, simply as an advertisement, and for this purpose alone it is also quite valuable in the country.

How much more attractive is the store or shop that is well lighted than the one that is dark and dingy. The subject is well worth the careful attention of our readers from a business point of view alone, independent of the care of the eyesight.

Oils are everywhere so cheap at the present time, and gas, in most places, is so reasonable in cost, that liberality in the matter of lighting cannot be regarded as extravagance by any one. On the contrary, it is true economy. —*Iron Age*, Dec. 30, 1880.

[From the London "Journal of Gas Lighting."]

Southern District Association of Gas Engineers and Managers.

The Quarterly Meeting of this Association was held, at the usual time, at the Guildhall Tavern, London—Mr. James Hunter, the President in the chair.

Mr. D. F. Goddard (Ipswich) read the following paper—

MANUFACTURE OF SULPHATE OF AMMONIA.

In bringing this subject under your notice, I feel I owe you some apology for dealing with matters on which so much has already been written; but it appears to me that there are comparatively few gas managers who, as yet, are working up their ammoniacal liquor, while so many might do so with great advantage. I do not propose to take up your time by going into the question of washing or scrubbing gas, nor to enter upon a minute description of the apparatus used in manufacture—this having been so efficiently done by the late Mr. Esson, of Cheltenham, and Mr. Eldridge, before the British Association of Gas Managers, as also in the article in "King's Treatise on Coal Gas"—but briefly to compare the different methods in use with a view to ascertain the most effective as well as the most economical means of making sulphate of ammonia.

The systems adopted for this purpose are many and varied, but the principles on which these systems work are few and simple. Omitting the most primitive method—namely, that of mixing the acid and the liquor in a lead vessel and evaporating down the resultant liquid to crystallization—as obsolete, on account of its nuisance, danger, and expense, I find there are mainly two, and very often three, operations in every system, viz.:—

1. A means of obtaining the ammonia from the liquor in a gaseous form.
2. An apparatus for fixing the ammonia vapor with sulphuric acid.
3. An evaporating pan to reduce the liquid sulphate of ammonia to the crystallizing point, and sometimes a means of breaking up the fixed salts of ammonia—the cyanides and sulphocyanides—which will not be given off by the simple application of heat.

I think it will simplify the discussion to follow, if I consider each operation *per se*, rather than deal with complete processes.

First, then, the means of obtaining the ammonia in a gaseous form. For this purpose some use an ordinary egg-ended boiler, or, at all events, a boiler without internal flues, into which the liquor from the works is placed. It is heated either by the direct action of a fire over which it is set, or by the introduction of steam into the liquor; the latter way being decidedly preferable, except on works too small to have a steam boiler. The heat must be applied slowly at first, until the carbonic acid and other noxious vapors are all driven off; the ammonia vapor, as formed, then passes from the boiler through a pipe to the sulphuric acid vessel. When the ammonia is all driven off, some lime is introduced into the boiler to break up any fixed salts of ammonia which may remain in solution.

Others use a column, after the design known as a Coffey still, containing many shelves, over which the liquor, entering at the top, passes, traversing each shelf in succession until it reaches the bottom, where it finds an outlet. The steam enters near the bottom, and passes also over the trays, but in an inverse direction, heating the liquor, and causing it to give up its volatile ammoniacal vapors, which, with the steam, pass out at the top of the still to the acid chamber. To obtain the best results, the liquor from the still should be passed into another vessel, and heated or stirred up with lime, to ensure no ammonia being lost as fixed salt.

In comparing these two plans, it seems that the former has the one advantage of dealing with the fixed salts of ammonia in the same operation as the volatile salts; while the latter requires another operation for this purpose; but, in my opinion, this does not compensate for the other advantages gained by using the Coffey still—namely, a saving of fuel by not having to heat so large a volume of liquid; less danger of nuisance from the foul gases (these, being given off more regularly and in smaller quantities, may be effectually burned in the boiler furnaces); and from its being almost a continous process—there being no boiler to empty and refill—more work in a given time.

Secondly, the apparatus for fixing the ammonia vapor with sulphuric acid. This, commonly called the saturator or absorber, is also of two forms, which may be designated the open or crystallizing saturator and the closed saturator. The former is usually of a rectangular form, made of stout timbers lined with 14 lb. lead. Half the top is covered over and divided from the other part by a lead partition, which descends nearly to the bottom. Into the covered portion the pipe from the still enters, and lies along the bottom being perforated with holes for the emission of the ammonia into the acid, while from the cover there rises a pipe to carry off the carbonic acid and sulphuretted hydrogen evolved. Some mother liquor and acid are put into the saturator, sufficient to seal off the covered portion, and the still is started; acid being added constantly as needed, and of such a strength as to produce crystals which are fished out and placed on a drainer. With the boiler arrangement of still this goes on until all the ammonia is driven off; with the Coffey still it may be continued as long as desired.

The closed saturator may be of similar construction, with the simple difference that the top is all covered in and quite tight. A charge of sulphuric acid is put into it, care being taken that the acid is not too strong, or crystals will be formed in the saturator—a result to be particularly avoided. I find acid of from 40° to 50° Twaddel the best strength. When the charge has been neutralized, as is ascertained by testing, it is run off through a regulus cock or lead plug into an open vessel, where any foreign matter or dirt may settle. Thence it is passed on to the evaporating pan, where, by means of steam pipes, it is reduced to its crystallizing point, and the sulphate taken out as formed, and placed on a drainer.

The treatment of the carbonic acid and sulphuretted hydrogen is similar in both forms of saturators. The pipes conveying them may I believe, be advantageously intercepted with another box containing sulphuric acid, to arrest any ammonia that might be taken up with the foul gases; but I cannot speak from experience on this matter. It must then pass through some form of condenser, and the uncondensable gases are carried into the boiler furnace or into the flue of the retort stack.

In comparing these two methods of fixing the ammonia, it would appear that what is done in the open saturator in one vessel requires three vessels when using the closed saturator. The former is therefore undoubtedly the cheaper to erect, and probably the more suitable for small works. Where it is desirable to make white salts, the results are more likely to be satisfactory by using the weak acid saturator and evaporating pan rather than that in which strong acid is used, as this tends to char and blacken any organic matter that may be present. It will also be more difficult to maintain the highest percentage of ammonia in the salts where these are taken from a strong acid solution, as the acid which hangs to the crystals would increase the weight, besides rendering the sulphate more liable to deliquesce. I may say, however, that I have seen some very excellent white sulphate produced by Mr. Browning, of Colchester, with the open saturator.

To come to the points of most importance to gas managers. Is it better to sell the ammoniacal liquor than to erect plant and manufacture sulphate? I think, with few exceptions, certainly the latter. Where works are so situate as, by water carriage and proximity of manufacturers, to command such a price as 1s. per ounce per butt, or say 20s. per ton, it would, I should think be wisest to let well alone; but then how few have such offers. The usual price with us is about half the sum I have named, and in all such cases it will be found highly advantageous to manufacture and sell the produce, as the following figures will show; they are based on a fair week's work, although the quantity produced could be increased by working for a greater number of hours—

Three tons of sulphate, at £18 5s. per ton				£54	15	0
Labor (one man), at 10d. per cwt.	£2	10	0			
Fuel (rough breeze) 52 cwt., at 9s. per ton.	1	3	5			
Acid, 3 tons, at 70s. per ton	10	10	0			
Repairs, etc., 15 per cent. on £500	1	8	9			
				£15	12	2
Balance of profit				£ 39	2	10

I estimate that it would require 8640 gallons of 10 oz. liquor to produce 3 tons of sulphate—that is 80 butts, at 1s. per ounce per butt, £40, showing at that price a slight advantage in favor of selling the liquor.

As to the question of the best apparatus to use. In small works a boiler set over a furnace, with the crystallizing form of saturator, would, no doubt, be cheapest and best; but in works where there is sufficient liquor to keep the apparatus generally in operation, I should recommend the Coffey still and closed saturator, as being most economical, most continuous, and requiring least attention.

I may say, in conclusion, that had I know, when the committee asked me to read a paper on this subject, that Mr. G. E. Stevenson would deal with the same topic before the Midland Association, and that we should have the pleasure of reading the description of his apparatus in the *Journal of Gas Lighting*, I, who use an almost identical form of plant, would have chosen another subject for consideration this afternoon.

Discussion.

The President said he was not a sulphate manufacturer himself, as he was able to get rid of his liquor at something like the price which had been named in the paper, and he was not, therefore, in a position to give a practical opinion on the matter, but no doubt many others present could do so.

Mr. Broadberry asked Mr. Goddard how he dealt with sulphuretted hydrogen in his apparatus. That point had not come out so fully in the paper as he (Mr. Broadberry) should have liked, for sulphuretted hydrogen was the principal difficulty, especially in small works.

Mr. Goddard said that at one time, after condensing the sulphuretted hydrogen gas as far possible, he passed it into the furnace under the boiler, but he found that it spoiled the boiler. After repairing the boiler they

started again, but then he found many complaints, coming from about two miles away from the works, of nuisance from the smell given off. For some time the people did not give the gas works credit for it, but after blaming every factory in the neighborhood in turn, they came to the conclusion that it was the gas works, and when about three miles from home one day he was very much astonished at the smell, for in the neighborhood of the works there was no smell whatever. On the hill, however, 2½ to 3 miles off it was disgusting, to say the least of it. After this they had to adopt another method, and now they had no complaints whatever. He had about 84 yards of 6-inch pipe as a condenser, and 30 yards of 16-inch pipe. He used a steam-jet exhauster, and conveyed the gases from the saturator, and his idea was that the steam would drop, which it did, and he found no difficulty in reducing the temperature to that of the atmosphere. He then passed the gas through an oxide purifier. Since adopting this method they had no complaints whatever.

In reply to another question, he said that where the boiler form of still was used, and the sulphuretted hydrogen was given off at once in large volumes, it was much more difficult to deal with. He believed, if the fact were generally known, it would be found that most gas managers who adopted that plan of working tried to start their operation either in the night, or so early in the morning that any objectionable fumes arising from it were not noticeable. But where the Coffey still was adopted the amount of sulphuretted hydrogen given off was regular throughout, and in small quantities. He had simply a 6-inch hot water pipe commencing in a lead pipe from the top of the saturator, then came the 5-inch pipe, which was carried backwards and forwards in a shallow concrete tank about 20 feet by 12 feet, the pipes being covered with water, and then, after allowing an outlet for the condensible matter, he conveyed it to the boiler fire. He did not know that there was any offensive odor from the shaft, dealing with it in that way. In fact, one might see the gases burning at the end of the pipe in the boiler fire, and when this was done his experience was that there was no offensive odor arising from it.

Mr. Broadberry inquired about what quantity of coal could be dealt with by the apparatus Mr. Goddard had described, the cost of which he gave at £500.

Mr. Goddard said about 12,000 tons. The £500 he mentioned really included the building, which was made of concrete, and cost under £200, and the apparatus he made and erected himself; consequently the cost of it was very little. He believed £500 would cover everything in the building.

Mr. Marshall said that in the various processes described by Mr. Goddard there seemed to be a considerable difficulty in satisfactorily disposing of the sulphuretted hydrogen formed. Some engineers burned it under the boiler furnace, while others turned the gas into the retort stack; but with both these methods there seemed a danger of the gas "firing back." Few, it appeared adopted the process of passing the sulphuretted hydrogen through oxide, although this was quite feasible, providing that it was freed from aqueous vapor by condensation; otherwise the purifier would soon get into an undesirable sloppy state. Another method for disposing of the sulphuretted hydrogen would be to burn it with nitrate of soda, and so manufacture sulphuric acid. Or another method would be by burning it, and passing the evolved sulphurous acid into water. A solution of sulphurous acid would thus be obtained, which could be used for the manufacture of bisulphite of ammonia from gas liquor. The bisulphite of ammonia readily absorbed the sulphuretted hydrogen, with the formation of water, and a deposition of sulphur which could be regained for future use.

Mr. J. L. Chapman said there was one point he could speak upon—viz., the question of the open system, which was the one he adopted. Mr. Broadberry had said something about the nuisance complained of under this system, but his (Mr. Chapman's) house was about 300 feet from the works, and they had had the sulphate apparatus going for some time, but had never had a single letter nor complaint to the company with regard to any nuisance. They carried the fumes through a pipe from 70 to 100 feet long, which acted as a condenser, catching the condensed liquid, and passing it over the tops of the retort into the retort flue; and up to the present time they had never experienced any nuisance whatever. They had an earthen vessel of acid with an earthen tap, and when they began sending the ammonia from the boiler into the saturator they turned the tap on very gently, so that the acid continually met the stream of ammonia, and thus the acid and ammonia were maintained as nearly equal as possible, thereby always keeping a regular flow, as Mr. Goddard described in the closed system. But he thought his (Mr. Chapman's) was more regular, because when the ammonia was let to flow into fresh acid, there must be a greater evolution of sulphuretted hydrogen than towards the close of the process. At Harrow they only put in as much acid as ammonia. As to the economy of the system, his was a small works, but they found they could work the open system very cheaply indeed. His leading stokers took the work in hand, with their regular employment, at a small price per ton of oxide made. They were 3 miles from the railway station, and 2½ miles from a canal, so that it was absolutely impossible to move the liquor; but with this system they were going on very satisfactorily, and he believed that for small companies, placed in difficult positions, the best thing was to adopt the open system; for, if carefully managed, it would show a fair profit to the company. This liquor was boiled in a straightforward manner by putting the fire underneath. The boiler held about 300 gallons of liquor, and it was boiled for 16 or 18 hours. It took about three hours to get it up to boiling point, and they employed for this purpose about six bushels of coke; but during the remaining hours they used nothing but the smallest coke breeze, which really cost nothing.

Mr. Lane asked if Mr. Chapman would prefer a fire under the boiler to a steam coil, or would it not be better to put the two in operation together? He said he found that the amount of ammonia which ran from his boilers was rather great, but they did not use a lime agitator. If the two heats were applied at the same time, it might effect a greater economy. In some works the Coffey still could not possibly be used.

Mr. Chapman asked if Mr. Lane meant that the ammoniacal liquor ran off too strong at the end.

Mr. Lane said he did. He almost thought it would answer his purpose better to sell the liquor which was being offered.

Mr. Chapman—Perhaps Mr. Lane was close to a railway station.

Mr. Lane replied that he was; they had a siding into the works. What he wanted to know was whether the steam coil and fire heat could be applied at the same time, and would it not be better than the steam coil itself, and also whether it was really beneficial to use the lime agitator? In some large works he had been informed to the contrary.

Mr. C. Gandon (Sydenham) said there was one point which Mr. Goddard had not touched upon, on which he should like to elicit some information, and that was the quantity of sulphate obtained per ton of coals. He was induced to refer to this because he had just been reading the recently published report of a paper on the same subject, read by Mr. G. E. Stevenson at the meeting of the Midland Association of Gas Managers, and there seemed to be very variable statements as to the amounts obtained. Mr. Stevenson produced 24 lbs. per ton, at Leeds they obtained 31 lbs. of sulphate per ton, and at Cheltenham 34 lbs. was said to be made. For his own part he was unable to obtain more than about 20 lbs. There must be some reason for these differences. At any rate he should consider he was working very badly indeed if he was working very wastefully. He had no doubt a great deal of the difference was due to the variation in the quality of the coal used, for they all knew that some coals contained much more ammonia than others. At the same time he was not at all satisfied with his own results, and should like to find out the way to get better ones. They used lime, and he had made experiments from time to time to ascertain whether it was at all worth while to do so. Some little time ago he made an analysis and found that the waste liquor contained ammonia sufficient to form about 341 grains of sulphate of ammonia per gallon—equal to about 1 cwt. of salt to be obtained out of a ton of liquor. This alone showed it was worth while to work up the waste liquor. At other times he had found more than double this amount of ammonia in waste liquor. There could be no doubt, therefore, that it was worth extracting; but whether the whole of it was obtainable by simply treating it with lime was a question. The 341 grains he named were obtained by treating the liquor with caustic soda, and it was astonishing how difficult it was to drive off the ammonia even with this material. He had found it necessary to boil the liquor for an hour or more, and with lime he had boiled it until he was tired, and then could not get the ammonia all away. He was not prepared to agree with Mr. Goddard that the Coffey still was more economical in point of fuel, although he had had much experience with the boiler system. There was undoubtedly a great waste of steam sometimes; the waste liquor came out of the bottom of the still, and the steam entered almost at the same place, and in practice a great deal of the steam, instead of going up the still, went out with the waste liquor. He had tried to prevent this by putting the outlet-pipe of the waste liquor into a seal, but the result was that it frequently blew the liquor over into the saturator, which was perhaps even worse than wasting a little steam. He did not take much account of the steam, because at his works they simply used ash-pan breeze for making it. Still the question of fuel was an important one. Mr. Goddard put £1 3s. 5d. for fuel for making three tons of salt. He (Mr. Gandon) did not know what rate he took it at, but if they used good coke it would require about a chaldron to make a ton of sulphate. He did not quite agree with Mr. Goddard in some of his details; but in the result he very nearly agreed with him. As to the foul gases, they at Sydenham did at one time attempt to burn them under the boiler furnace, and he very frequently found there was a great nuisance from them. If the furnaces required clinkering, the gases could not pass up through the clinker, or if they had just been clinkered, and coke put on, there was nothing to consume the gas. They had, therefore, now adopted the plan of turning the gases into the main flue at the top of the retorts. How people at a distance might like it he did not know, but he had not

heard any complaints; still as the gas given off was mostly sulphurous acid, he did not think any inconvenience was suffered. With regard to the labor in making the salt, which was also a point referred to in Mr. Stevenson's excellent paper, the statement was made that the cost of manufacturing sulphate at Leeds was 8s. per ton. Mr. Stevenson gave his cost at 24s., and this difference was enormous. He (Mr. Gandon) thought this must be due to some different way of keeping accounts. He never heard of salt being made at 8s. per ton, though he had known, in a very small works, where the stokers had a little spare time, they used to give them 12s. or 14s. a ton to look after the sulphate apparatus, and as it was an open affair it was not much trouble to do this. That was the cheapest he had heard of. At his own works they paid 22s. for making the salt, which included labor and all repairs, but the company had to find materials. Altogether it cost, taking the renewal of plant and all, about 28s. per ton, or £1 per ton more than it was stated to have cost at Leeds. He did not know whether or not this was due to their bad working, but he should be glad if any one could show him how to do it cheaper.

Mr. Botley asked whether Mr. Goddard used the lime process. With regard to the advantage of selling liquor or manufacturing it, he might state that he found such difficulty in getting rid of his liquor, that he was about to put up plant for the liquor from about 12,000 tons of coal per annum, because they could not get rid of it at a fair price. But even without this difficulty, there were endless disputes with manufacturers as to the strength of liquor sold. They were determined to give up the sale of liquor altogether and make sulphate themselves.

Mr. Eldridge said the question of nuisance was no doubt a very serious one. He had now been making sulphate for the past ten years, and certainly had had just a few complaints; but none that were persisted in. Sometimes persons professed to smell something when there was nothing to smell. For instance, not long ago he was talking on the subject to a gentleman who would not believe that sulphate of ammonia could be made without causing a serious nuisance. A few days after he was going through the gas works, and, sniffing very obtrusively, said, "Now, what do you say? Is there no smell to-day?" observing that the wind was coming right in the direction from the apparatus. The fact was, however, they had not been at work for a week. Nevertheless, he (Mr. Eldridge) must say they had sometimes not felt quite comfortable, and could perceive that there were slight smells about. Some time ago he tried the following plan, which answered very well: Instead of putting into the saturator the ordinary dilute acid—say half water and half sulphuric acid—and driving the ammoniated steam from it into the boiler, he filled up the saiurator (a tank about 5 feet by 3 feet by 2 feet 6 inches), nearly full of water. He drove the steam from the boiler into it, and let a very little acid dribble in from an elevated tank, a few drops at a time; and that continued during the whole process, which went on for about twelve hours. When he wanted to take it out for the purpose of putting it into the evaporator, it was a bad color; but the next process would be to syphon it into a settling-tank, and then to syphon it into another evaporator. Using so large a quantity of water, he never formed any salt in this saturator. At first they used to form salt in the saturator, and dig it out; but now they syphoned it out into the settling-tank, and when it had stood there about six hours, put it into the socond evaporator. They now found no smell at all, even working with a perfectly open saturator, although, as a matter of precaution, they had a pipe fixed which led from the top of it to the furnace. A question had been raised about lime, and he must say that up to lately he had always thought it was no good using lime. The general impression was that it did not pay for the trouble and the little that was lost was very trifling. Some time ago, however, he filled a tank about 6 feet in diameter, and 4 feet deep, outside the works altogether, so arranged that he could draw the spent liquor from the boiler into it. He put a coil at the bottom of it, and churned the liquor with lime. This soon settled the question in his mind as to the value of using lime. Mr. Gandon said some time ago there could be no question about its being of no use, and others said the same; but by the means he had ascribed he obtained very fine salt indeed.

Mr. Valon said he had listened with great pleasure to the paper and discussion. As far as the cost of manufacturing was concerned, his results agreed as nearly as possible with the figures Mr. Gandon had given; in fact he agreed with him in almost everything he had said, excepting in the quantity of salt he manufactured per ton of coal carbonized. He presumed at at Sydenham they used Newcastle coal, the same as he (Mr. Valon) did; but he got about 24 lbs. to 25 lbs. of salt per ton. With regard to the question of getting rid of the noxious vapors, he used steam to drive off the ammoniacal vapors into the saturator. He used the open system, mixing the acid in the proportion of two parts of water to one part of 80 per cent. acid, and they put it all in at once. They then drove the fumes over until the liquor was saturated, then put it into a settling tank, and then re-pumped it into the evaporator. To get rid of the fumes they had a 6-inch pipe from the saturator, which discharged on the top of the furnace immediately under the boiler—not in the ash-pan, as if there were any clinkering or anything of that kind the fumes would come out and choke the men. He had tried in every way to find, either close to the works or at a distance, anything of a noxious character, but had failed to do so. They did find sulphurous acid gas which fell down close to the works, but nothing more; and they had no complaints from their neighbors. He therefore had no reason to think that any other system would be better than the one he had adopted.

Mr. Broadberry said he had compared his cost with the figures given by Mr. Gandon; and also, on reading the account of the meeting of the Midland Association, he was much struck with the discrepancy in the quantity of salt made. At his works they had made ammoniacal salt for many years.

He found that his fuel cost about 8s. per ton of salt made, and the labor about 18s. per ton, whilst he made about 22 lbs. of sulphate per ton of coal carbonized. This included repairs and all, because the repairs were kept apart, and not mixed up with other labor. With regard to the use of lime, he had employed it, and found that he really obtained about 9 per cent. more salt in consequence. He did not always use it, however, because in changing men they sometimes found a difficulty in getting them into the system, and when a fresh man was put on they did not use the lime until he was well acquainted with the work. With regard to applying heat direct or by steam, he applied direct heat for about 15 months, but had to alter it to steam—not a coil, but a perforated pipe which ran along the bottom of the boiler from which he blew the steam direct into it. He thought this was more effective than a coil. He had to do this because when the ammonia first began to come off, if the heat were applied direct, it sometimes came off more quickly than it could be dealt with, and by this means they found they lost a large quantity of ammonia, not using a check tank. By using a check tank perhaps the difficulty might be overcome; he, however, still thought the steam was preferable, because the evolution of ammonia could be regulated much better by its means.

Mr. Valon said he had tried lime to commence with, and found it rather a dirty process and a great nuisance, and he had since tried to do away with it, and succeeded in the following way:

Tney took the spent liquor, ran it out into a tank and cooled it, and then ran it again into the washers and used it over and over again. Of course it decreased, and they had to add pure water to the scrubber, but the spent liquor was passed into the first washer.

Mr. Gandon said he was doing the same thing with his waste liquor to a great extent, although he did lime a portion of it.

Mr. Eldridge said he had tried this plan, but found it impossible to get rid of the liquor.

Mr. Valon could not understand this, because every time the liquor ran through the boiler it must be reduced in quantity, and therefore he could not see why they could not get rid of it.

Mr. E. Price (Hampton) said he had carried out this plan with success for about nine years, running the liquor back again after extracting all the ammonia, and therefore he did not trouble about the fixed ammonia. It went back into the tanks, and was worked over again. The question of nuisance was a most important one to consider. They had all been troubled more or less with this matter in the manufacture of sulphate; at all events, he had, and had tried various plans to get rid of it. He first tried condensing the fumes, but without success; then he tried running the fumes into the flue of the retort-stack, and carrying them up into a shaft about 120 feet high; but then he found that complaints were made, about a mile from the works, that the gases fell near the Hampton Court Palace, and therefore he had to abandon the system. Then he tried another plan, by running it direct into the front of the settings, so that it travelled along the flues; but this was very destructive to the retort benches, and he was obliged to abandon that also. Then he tried another plan of burning them under the boiler. He had at the present time an egg-ended boiler, and he ran the fumes into the side of the furnace directly over the fire, and this he found to be successful; but before they came into the furnace he had a closed system of saturators. Between the saturators there was a catch cistern, so that all the fumes went over into this catch tank, and then there was another outlet from it which took away the steam, so that the liquor of the water ran away from this middle or catch tank, and did not go round into the tanks. Then he had also another one outside the works under ground—a little tank which also caught the liquor that might travel along from the tank outside. Since he had adopted this system he never had the slightest trouble or complaint from any one. A great deal of the success, however, depended on having a good draught in the furnace, and unless there was a good draught the fumes would not burn away. He had just erected a new Cornish boiler, with which he could obtain any amount of draught, and he did not find the slightest difficulty in consuming the fumes.

Mr. Eldridge said there was this advantage about the lime, in using it and putting the spent liquor into the lime tank, and passing steam through it,

the water in the tank was made fit for anything, so that if it was necessary to throw it over hot coke, or, as some of his friends did, send it to the Atlantic and other places, there was no annoyance caused; in fact, the water when it ran out of the tank might be thrown anywhere, and this was an additional advantage from the use of lime, besides the saving of salt.

Mr. Marshall said, with regard to the decomposition of the fixed salts of ammonia—viz., the carbonate and sulphide—doubt existed whether the mere action of steam would effect the entire decomposition of the salts; but from various experiments he had carried out he was induced to think that the decomposition was not complete, as the following analyses would show:

NH_3		CO_2		H_2S.	
Cubic inches per Gallon.		Cubic inches per Gallon.		Cubic inches per Gallon.	
Before Heating.	After Heating to 200° F.	Before Heating.	After Heating to 200°F.	Before Heating.	After Heating to 200°F.
9804	5635	3336	615	2118	1275

The samples of liquor were heated to 200°F., and the carbonic acid, sulphuretted hydrogen and ammonia estimated before and after heating. After heating, both the two former existed in the combined state—viz., as carbonate and sulphide of ammonium; clearly pointing to the fact that the reaction was not complete, and that those who were content to simply heat their liquor, and neglected to use lime, must suffer a considerable loss of ammonia, to say nothing of that which existed as cyanides.

Mr. J. Hammond (Lewes) said the vital question in the paper appeared to be whether it was better to sell the liquor than work it up into sulphate. He thought they ought as managers to make the most of the ammonia before disposing of it, either as a residual liquor or as sulphate of ammonia, and they could do this by utilizing it for purification purposes. He had a little apparatus which he used in this way:

A small pump was at work continually night and day drawing say fifty gallons of crude ammoniacal liquor per hour from the ordinary tar and liquor well. The liquor was forced through the apparatus and purified therein before reaching the scrubber and washer. Steam was not brought into direct contact with the liquor, but the plant was so arranged that he used a very small amount of steam to drive off almost the whole of the sulphuretted hydrogen and carbonic acid from the liquor. These gases carried off also a small quantity of ammonia, which became converted to sulphate in the saturator, while the hot liquid ammonia flowed on through the apparatus, heating in its course the ascending crude liquor, and flowing out cold to the scrubber and washer for the purification of the gas. So that he needed no Coffey still, no boiler set over a fire, nor did he need a steam pipe leading into a large boiler with a great bulk of ammoniacal liquor under treatment at one time in order to manufacture ammonia sulphate. By continually pumping a small stream of liquor through the apparatus and driving off by steam heat the impurities, combined with a small quantity of ammonia, through acid, he could produce good sulphate, and at the same time greatly assist in the purification of the gas with the purified liquor. To dispose of the surplus liquor he had provided a little receptacle which would catch the purified liquor while hot. This was arranged at a certain height, and the liquor flowed in a regulated quantity into small vessels for treatment with lime and high-pressure steam, thus producing strong ammoniacal vapor and liquid ammonia, which could be led away to assist in purifying the gas, or forced through the acid in the saturator for sulphate making. He therefore had two distinct processes at work in dealing with the ammoniacal liquor, and he found it best, because by dealing with it in this way, he did not increase but rather decreased the quantity of liquor remaining to be treated with lime.

He had been working at this matter for some years, and was so pleased with the results, that he hoped at some future day to bring the matter before the Association in the form of another paper; but having been in some confusion for the past two years with necessary extensions and alterations of gas works plant, he had not been able to fulfil the promise which he made when he read his former paper. It was certainly clear to him that there was a very easy way in which they could make use of ammoniacal liquor over and over again for the purpose of purifying gas, and at the same time convert only the surplus liquor into sulphate of ammonia. He had never any very strong carbonate or sulphide liquor on the works. The continuous treatment with steam kept the bulk of the liquor as low as 2½° Twaddel, but it really contained 14 ounces or more of ammonia per gallon, which made it so valuable as a purifying agent; and the small but continuous quantity under treatment at one time prevented any danger or nuisance from excess of foul gases. If they could combine the process simultaneously of manufacturing sulphate and the purification of gas, he thought it would be far more profitable, and better than sending the crude liquor off the works as soon as made.

Mr. Marshall said, with regard to the sulphate made per ton of coals, this seemed to vary greatly with the different makers. Mr. Goddard had, he believed, stated that he obtained 24 lbs. of sulphate (of 25 per cent. quality) per ton of coals. This was very good working. They had heard statements of results approaching 34 lbs. of sulphate per ton of coals, but this would probably be accounted for by the makers using inland coal very rich in nitrogen. The practical results obtained by makers who used Newcastle coals, and who made 30 gallons per ton of 8-ounce liquor by the "acid" test, equal to 9-ounce liquor by the "distillation" test, (this showing the total amount of ammonia available), was, he believed, about 23 lbs. of sulphate per ton, and this would be theoretically correct, for assuming that one ton of coal produced 30 gallons of 8-ounce acid liquor, or 9-ounce "distillation," liquor, then 100 tons coal would give 3000 gals., or 28 butts, and this would produce theoretically 22·87 lbs. of sulphate per ton. Taking as a basis one ounce of strong acid to equal 0·347 ounces of ammonia, then by taking the "distillation" ounce strength, say nine ounces, and multiplying by 0·841 equals 7·569, divided by 10 equals 0·7569 pound of sulphate per gallon, or 2287 pounds of sulphate per 100 tons of coal, or 22·87 pounds per ton.

Mr. John Chapman said he was glad to find that though Mr. Goddard had stated that small works could not set up valuable machinery for making sulphate, still he gave some hopes to those who were engaged in small works that they could make something out of their liquor by taking care of it.

Mr. T. May (Canterbury) said he had manufactured sulphate of ammonia with a good deal of success, and with no nuisance. His was the close process, and the noxious gases from the saturator were taken to the boiler, the flue of which was connected with the chimney shaft. No nuisance had arisen, nor had they any complaints for years, though last year they manufactured 84 tons of sulphate. The apparatus was economically manufactured on the works, and cost £150, including boiler, saturator, depositing tank, evaporator and drainer, and also all the pipes and setting the brickwork. The saturator was entirely of lead, set alone and circular. The sulphate made was a white first-class article, and he produced 22 pounds per ton of coal carbonized. The cost, including fuel, labor and packing was 20s. per ton. This did not include any repairs, because there had been none since the apparatus was set up.

Mr. Goddard, in reply to Mr. Marshall, as to getting rid of the nuisance, said his own experience was that there need be no nuisance. They ought properly to condense the sulphuretted hydrogen and carbonic acid gas through a water condenser such as he had described, and then carry the fumes to the fire of a Cornish boiler, not below the fire-bars, but above them, where there was nothing to prevent them being driven off. If there was a nuisance it might be wise to consider the advisability of following out Mr. Marshall's idea; but he need not remind the members that the more complicated he made these processes the more necessity there was for skilled labor in working them, which was not desirable. Mr. Chapman had said something about the ammonia given off being irregular, but with the Coffey still arrangement this was not so; there was always the same quantity of liquor passing through the still—averaging from 150 to 200 gallons per hour. This only represented a given quantity of sulphuretted hydrogen, and was always the same. In reply to Mr. Lane's question as to applying two heats at once, he should say there could be no advantage in doing it. The great object in introducing steam into the boiler was to reduce the fuel underneath the boiler, and also because if there was direct heat, too great a heat might be applied at one time, and the ammonia be driven off too quickly, when some would be lost. The heat would be readily stopped in a moment if it were found that the ammonia was coming off too quickly. Where a boiler was used, and the steam introduced into the boiler with the liquor, no agitator was required for the lime. In reply to Mr. Gandon as to the make of sulphate per ton, he believed the difference in quantity made by different companies was entirely due to the different kinds of coal which they used. He had made some very careful examinations with the view of obtaining a basis to go upon, which would work out very similar to the figures given by Mr. Marshall—namely, as to the quantity of liquor and the strength of liquor used in washing the gas. If they knew what was the strength of the liquor they obtained, they could easily calculate what amount of sulphur they ought to get. The results of his tests on the scrubber was that he passed between 24 and 25 gallons—to give the exact figures, 24.75 gallons of water per ton, and this came from the bottom of the scrubber 14-oz. liquor. Working in this form, which was theoretically correct, the 14 oz. liquor produced 17.5 oz. of sulphate per gallon, which practically was 27 lbs. of sulphate per ton of coal. He did not say that he had obtained these results, but was merely giving the quantity of water used in scrubbing, and the strength it came to. Even if

it only produced 14 oz. of sulphate of ammonia per gallon, it would represent 21 lbs. of sulphate per ton of coal carbonized, without at all reckoning the liquor which was formed in some hydraulic mains or through the condenser. He, therefore, could see no difficulty whatever in the figures running up to 24 or 25 lbs. per ton of coal. Where some Yorkshire coal was used the figures that were quoted by the late Mr. Esson, of 24 lbs. per ton, might be correct. As to the question whether lime was sufficient to get all the fixed salts from the liquor resulting from the still, he did not think it was, for a moment, but it was easily tested. He had tested it, and found some sulpho-cyanide of ammonium left. Simply by applying a persalt of iron to the liquor, the presence of sulpho-cyanide of ammonium was detected by the deep red precipitate; and he found that really all the sulpho-cyanide of ammonium could not be got rid of. However, a great deal of it could be got rid of—quite enough to make it worth while. As to the waste of steam, which Mr. Gandon complained of in using the Coffey still, he (Mr. Goddard) could not say that he found the difficulty he spoke of, of the steam coming out from the bottom of the still. Probably he did not work in exactly the same way. At Ipswich he did not get the liquid running from the still, but there was a space at the bottom of the still below the shelves, and the liquor accumulated there to perhaps 12 or 18 inches. It was tested from time to time to see that the free ammonia was all extracted from it, and when this was found to be the case it was allowed to be run off, and the cock of the apparatus was shut again. By this means there was no material waste of steam. He need not enter into the question of labor, but his labor was a fixed sum. He paid his one man for the sulphate 10d. per cwt. according to the amount sold, In reply to Mr. Botley, he might say that up to the present time he had not been in the habit of using the lime process at all, but he most firmly believed it was worth while to do so, and was now erecting plant for the purpose of using it. As to putting a large quantity of water into the saturator, as recommended by Mr. Eldridge, he would remind them that the more water they had in the saturator, the more fuel would be required to evaporate it down to the crystallizing point, and that therefore it must be rather more expensive. One gentleman had said that they had used the spent liquor, or fixed salt liquor, as he called it, in the washers, and that was certainly a way of getting rid of the liquor for a time, but he could not see that it did any permanent good to the gas. The fixed salt liquor had simply some sulphide of ammonium and some sulpho-cyanide of ammonium in it, and in course of time the fixed salt in the liquor must be increased, and there would necessarily be greater waste than if it were removed. He, therefore, thought that the better plan was to remove it at once by means of the lime process, rather than use it in the washers. As to Mr. Marshall's question, whether the whole of the ammonia was extracted by steam, he did not think any cyanide of ammonium was extracted by steam, but simply carbonate and sulphate.

Mr. Marshall said the point was whether they were thoroughly extracted by steam.

Mr. Goddard thought that if the sulphide and carbonate of ammonia were not driven off by steam, they would be detected in the liquor by means of a test-paper. He thought, therefore, that these salts of ammonia, which should perhaps be termed the volatile salts, were all driven off, but that the cyanides and sulpho-cyanides were not touched at all. The quotation that 30 butts of 8-oz. liquor would produce a ton of sulphate, was, as near as possible, the same as the figures he had given—80 butts of 10-oz. liquor to produce 3 tons.

Mr. Marshall said this was the amount the London manufacturers were now reckoning upon, so that Mr. Goddard's amounts tallied very correctly with them.

Mr. Goddard said he quite agreed with Mr. Hammond that if they could put the ammonia into a utilizable form before manufacturing it into sulphate, it would be greatly to their advantage to do so, but he thought at present there must be some little difficulty in doing it; because, although they had heard that Mr. Hammond was doing it, he did not exactly understand how he accomplished it, and he could not ascertain that anybody else was doing as Mr. Hammond said he did. He should, therefore, be only too glad when his ideas were laid before the association in such a way that they could adopt some process whereby they could convert all their ammoniacal liquor into caustic ammonia for the purpose of purifying gas before making it into sulphate of ammonia for sale.

The president said he had been much pleased at listening to the discussion, and it had given him many new ideas, which, no doubt, would some day be useful to him. On reading in the *Journal of Gas Lighting* the paper to which reference had been made, there seemed to be a good deal of discrepancy as to the results, both with reference to the quantity of salt produced and the cost. As had been truly remarked, the strength of the ammonia ought to be given in all cases, so that they might arrive at something like a criterion of each person's working. They must be guided wholly by the practical result; the pounds, shillings, and pence was the great test, as far as the companies were concerned. Men might theorize for a long time without attaining a profitable result, but if the figures were given showing the strength of the liquor, the amount of fuel used, the proper cost of labor, and so on, it would throw much light on the question. He had noticed for years past, with reference to the manufacture of sulphate in the usual form, that gas companies had been much complained of for the nuisance arising from the sulphuretted hydrogen. This was one point which those who made sulphate ought to turn their attention to, so as to remove the nuisance and prevent the sulphuretted hydrogen passing into the air. Some other means beside passing it under the boiler might be adopted, and Mr. Marshall had named one which he thought might be brought to a practical issue. Mr. Goddard's paper had been an extremely valuable one, first of all because of its own excellence, and secondly from the amount of discussion to which it had given rise, and after all this was the great point—the amount of practical experience which was elicited in discussions. He had much pleasure, therefore, in proposing a vote of thanks to Mr. Goddard for his paper.

Mr. Broadberry seconded the motion, which was carried unanimously.

This closed the business of the meeting, and the members afterwards took tea together.

[From the London "Journal of Gas Lighting."]

West of Scotland Association of Gas Managers.

Mr. Dalziel (Kilmarnock) read the following paper:

ON THE TREATMENT OF RESIDUALS.

First Paper.

Our worthy Secretary has put me down for a paper on residuals. I hope that he meant thereby, and that your expectations are limited to the bye-products tar and ammoniacal liquor.

I doubt not it is in the recollection of some of the older members of this Association that, in the earlier days of gas making, these articles were a heavy drawback or drug in the conduct of gas works. There was no market for them, and I have heard it asserted frequently that the liquor was sent down some adjacent burn in a spate, and a pit dug to bury the tar. Happily our lot has been cast in happier times, and if we choose to work them ourselves they will yield a good return, or if we prefer to sell there are many willing to give a good price. Either way residuals have become within the past 30 years an important source of income; in my own case, during the last four years, being equal from 5s. to 5s. 3½d. per ton of coal carbonized. I believe that, notwithstanding the grand discoveries which science has made, by the researches into the constitution of coal tar and its many compounds, better days are in store, and better prices still will be obtained for these articles, and in every gas works this will be a department to which gas shareholders will look for a fair if not a good return for the money invested. In giving a receipt for the making of hare soup, Mrs. Glasse says the first thing is to catch your hare. Now, in many of our gas works we have allowed the "hare" to slip through our hands, to our own detriment and expense in the purification, and what should be a source of income is the author of expense and waste, not to mention the intolerable stench that arises when a purifier is changed in works where no scrubber or washer is used.

In 1872, when I was appointed manager, the time had come in which it was absolutely necessary that large extensions of the works should be made. The wave of prosperity that swept across the land in 1873 had begun to rise, and I may say I was caught between two Boards—the Board of Directors of the Company, and the Committee of the Corporation. The season was well advanced, and there was no time to plan, renew, or extend any part of the works. I immediately set about repairing the plant to the best of my ability, in order to get through the first winter; and I may state that that winter I gained experience which only falls to man's lot once in his lifetime, and only to those similarly circumstanced to myself. At the end of my first year I found that in some things I was not worse than formerly, but in regard to residuals I had fallen behind. I had not done so well as I expected, and was considerably disappointed. I cannot say at this time whether it was in the return per ton of coal or a fall in the price of residuals, but I was chagrined to find myself in the background with regard to this department. In the first year of my working I only made 16 lbs. 3½ oz. of saleable ammonia per ton of coal.

At this time I had one scrubber 20 feet high and 4 feet 3 inches wide, and had become satisfied that an additional one would be an advantage. Accordingly, in the winter of 1873–4, when I enlarged my purifiers, I added an additional scrubber, with the result that, although not finished till the new year, at the end of the new year I found the make of sulphate of ammonia had increased 2½ lbs. per ton of coal carbonized, although the best part of the season was past when the scrubber was put into operation. In the following year (1874–5) I derived the full benefit from this extension, by selling 21½ lbs. of sulphate per ton of coal. You will observe that the addi-

tional scrubber gave me 5 lbs. of sulphate of ammonia per ton of coal more in the year 1875 than in 1873.

During the winter of 1874-5 I was very much tantalized by finding that my first scrubber was not behaving in the manner a good scrubber ought to do. I found that in running it off it had been imbibing a goodly portion of tar and the lighter oils, the condensers apparently having gone off or shirked their duty on finding themselves overwrought, and had apportioned a part of their work to scrubber No. 1, with the effect that although scrubber No. 2 was always up to the mark, when I passed the water of No. 2 into No. 1, I could not get No. 1 to increase more than a degree in strength, although it had the first of the gas; thus convincing me that, from the tarry nature of the water, the condensers had not cooling surface enough to perform the work required of them.

What follows shows how essential it is that every piece of apparatus, in a gas works at least, shuld be quite equal to and more than sufficient for the work required of it. In the autumn of 1875 I doubled my condensing power, the result being that at the end of the season I had made of good saleable sulphate of ammonia 24½ lbs. per ton of coal carbonized; and from that time to the present—that is, for the past four years—my make of sulphate has ranged from 26¼ lbs. to 27 lbs. 3 oz. sold per ton of coal.

I think it is Mr. R. H. Patterson who makes the remark that the manufacture of gas begins in the retort and ends in the hydraulic. In addition to this I would say that our bye-products are also made there, and are influenced very materially by the heat at which the coals are carbonized in the retorts, and I am inclined to hold the opinion that if the heats in our retorts are raised beyond a bright orange, it will result in reducing the illuminating power of the gas. I grant that a larger volume of gas is made per ton of coal, but it is at the expense of the tar, and also of the ammoniacal liquor, which I consider is deteriorated in quality, the tendency being to convert ammonia into cyanogen gas. At the same time, I believe in Mr. Newbigging's motto—"Keep up the heats"—and I am afraid that some of us would work at higher heats if we could have them. At the same time I am quite satisfied that heat carried beyond a certain point does not result in additional profit, but perhaps in positive loss, on account of the extra wear and tear of retorts, as well as a poorer return for bye-products. I remember a year ago comparing notes with other works, one in particular which is managed by one of the cleverest men in the profession, and stands high in general working, and I found that though I had not sold nearly so much gas per ton of coal, the income from bye-products fully met, and a little more, the difference; that is, valuing the number of thousand cubic feet of gas sold per ton, and the income derived from the bye-products, when I summed up the gains from both together, comparing the value of the coals, the gain was on my side, but possibly, if full details could have been obtained, it might not have resulted so favorably for me. In works where the bye-products are worked up, it is not so material what the heats employed may be, but every manager should do his best for both departments; and then he has the satisfaction, that should anything be lost in the retort house, it is recovered in the chemical works.

I must not, however, be misunderstood, for, as managers of gas works, our primary duty is to manufacture gas—get as much as we can of it per ton of coal, and of such a quality as will satisfy even the most fastidious consumers. After we have made the gas in the retorts, and it has taken its first plunge bath into the main, purification begins; the the gas begins to part with its tar and liquor. Pushing on to the condenser, this process is further carried on, and in my condensers, which are battery condensers, I always have in addition to tar and water a large deposit of carbonate of ammonia, so much so that in mid-winter I have to wash the condensers in warm water sometimes twice a week, to prevent choking, in fact, I have to watch them daily to keep things moving right, and I am considering whether it would not be advisable to have a very small jet of steam entering with the gas into the condenser, to supply moisture to prevent the carbonate of ammonia from crystallizing. Presuming that the condensers are doing their duty, and the gas reaches the scrubber free from tar, the gas is just in the condition in which scrubbing is effected at the moment it enters the scrubber, the attractive power of the water for the ammonia being so great that it instantly seizes and holds it in solution; it is what the German, in describing "likings and dislikings," calls "*Lust und Unlust*," the attraction for each other being so great that they go together with a rush. Water at 60° will take up as much as 500 times its own bulk; that is, 1 gallon of water will take up 500 gallons of ammonia. So here is an agent that costs nothing, which was once thrown away, a willing servant, ready to assist us in the work of purification, and adding considerably to our revenue. The mixture of water and ammonia is not a new chemical compound, neither is it chemical affinity; but it is a mechanical attraction the one has for the other, and the colder the water the more ammonia will it hold in solution; thus in winter, when it is most needful, the scrubbers are in the best condition to perform their work. At this point not only is ammonia taken up, but also, it is said, "carbonic acid, hydrosulphuric acid, hydrocyanic acid, and sulphocyanic acid, and, in addition to these, ammoniacal liquor, which contains hydrochloric acid." These water takes up readily, and this accounts for the fact that the liquor of our gas works is denser than pure ammonia water. Supposing water to be 1000, a solution of strong ammoniacal liquor is about 870, whereas gas works liquor at 5° Twaddel would be 1025. The compounds before mentioned add to the specific gravity of the liquor, but not always to its commercial value; still, in my own working, I have found that when proper attention has been given to the stills, etc., the results have always been in proportion to the strength of the liquor.

I have two scrubbers, which I will call No. 1 and No. 2; No. 1 being the first, No. 2 the second to which the gas passes. No. 2 I will fill up with clean water, and when it has become saturated up to 3° or 3½° Twaddel, I run off No. 1, which by this time has gone up to 7° or 8° at the most—that is, 14 to 16 oz. liquor—and the weak liquor of No. 2 is run into No. 1, and I refill No. 2 with clean water again, so that gas the has nearly always fresh water to come in contact with. The strength of the condenser liquor I have found as high as 6° and as low as 2½°, or 5 oz. liquor; and the average, when the liquor of No. 1 scrubber is run off, brings it up to 5° and 5½°; that is, that the specific gravity of the liquor which I fill into my boiler is from 1025 to 1030, and on a rare occasion it rises to 1036. This has occurred when I have been steaming out the condensers or the receiving tar tanks. The crystals of ammonia are dissolved, and run on to the tar wells, the liquor on these occasions sometimes ranging over 6° Twaddel. There is another source of very strong liquor—namely, from the tar still. One would be disposed to think that, from the nature of green tar, and the appearance of it after standing for some time, there would be little water in it; but in a boiling of green tar of say 2400 gallons, I get from 90 to 100 gallons of naphtha, about 400 gallons of ammoniacal liquor, and 1900 gallons of boiled tar. This liquor that separates from the tar at the beginning of the distillation is as high as 14° to 15° Twaddel, coming down to water at the close; the average strength of the liquor in green tar is from 7° to 8° Twaddel, or 14 to 16 oz. liquor. The density of the liquor is the cause why it does not separate from the green tar, the specific gravity of liquor being so near to it that it is not light enough to come to the top surface of the strong liquor which it holds in suspension, and which is returned during the distillation of the green tar to the tar well.

What I have been saying has been chiefly in regard to the ammoniacal liquor. In reference to tar, in order to cleanse the gas from this substance condensation only is required; and, as I have shown, when I enlarged my condensers, the gas having been cleansed or purified from tar, the operations of the scrubbers and the purifiers also were more active, and did better the work that was assigned to them. Hence, as I have already remarked, the necessity of having all our apparatus quite, and even more than equal to the work required of them, otherwise if there is a lack of condensing power, there is a loss of a return for tar, also for ammonia. If the scrubber has to do the work of a condenser, then the purifiers have more to do, so that more lime is used than would be needful if all the apparatus were up to the point in size and doing their work efficiently.

This is a matter which all managers should try to impress upon directors of companies and committees of corporations—viz., that judicious expenditure on plant always meets a sure reward in the shape of 10 per cent. dividends upon the capital employed. The liberal man deviseth liberal things. It is a great falacy and false economy that hampers a manager in any one portion of his plant. In reference to this particular article, ammonia, each portion paid itself in the first eighteen months; and I would advise all managers situated as I was myself to induce their directors to put their hands into their pockets and enlarge their condensers, or put down an additional scrubber. The increased dividend jingling in their pockets at the end of the first year would, I hope, enlarge their hearts, and cause them to let the manager also, who has the oversight of these matters, share in their prosperity.

Discussion.

The President said he should like to know from Mr. Dalziel whether it would be profitable for small gas works to utilize their own residual products, and what additional capital would be necessary to enable them to do so. If this point were made clear, he had no doubt that many corporations and gas companies would begin at once to work up their residuals. Every one was aware that a large sum was annually expended for these residuals in the shape of carriage alone, and if it paid others to do this—he did not think there could be any doubt on this point—he did not see why it should not pay companies and corporations. The only question with him was what annual make of gas would be necessary to render such works profitable.

Mr. Nivin considered that the chemistry of the residuals had been exceedingly well brought out in the paper. In regard to the commercial question raised by the President, it was, he thought, for each one to decide for himself. He understood that the paper was only preparatory to an-

other, in which he had no doubt Mr. Dalziel would give all particulars from a commercial point of view. He would not, therefore, anticipate these particulars by asking questions.

Mr. Dalziel said there was one thing he wished to bring under the notice of the meeting—namely, that some gas works had not the necessary power to propel machinery; but now that gas engines were so handy he should say that every manager ought to have a scrubber. He was certain that if those who had not such mechanical power would only introduce a gas engine, they would nearly double their make of ammoniacal liquor. Here alone there was a large return from a substance which ought to be taken out of the gas before it went to the purifiers. He stated that he meant to give a paper on this subject—bringing out further details—at the next meeting.

[From the Toronto "Mail," Dec. 14.]

Alleged Poisonous Gas.

MEETING OF THE SPECIAL COMMITTEE—THE MANAGERS OF THE GAS COMPANY HEARD—REPORT OF THE COMMITTEE—ITS CONSIDERATION DEFERRED.

A Special Committee, appointed by the City Council to inquire into and report upon the character of the gas at present supplied to the citizens, met yesterday afternoon, Ald. Walker presiding. The other members present were Messrs. Love, Trees, and Adamson; and Messrs. Pearson, Austin, and Smith were in attendance on behalf of the Gas Company.

Mr. Pearson was heard at considerable length in defense of the gas, which he contended was as good as any manufactured; and he read from reports of chemists in various parts, including England, France, and the United Scates, to prove what he had contended for.

Mr. Austin also briefly addressed the committee in support of Mr. Pearson's assertions.

A committee under whose directions the following report was prepared, submitted it, and consented to defer the consideration thereof until the next meeting:

"Your Committee beg to report that owing to the important nature of the inquiry intrusted to them, they have endeavored to obtain the fullest information from the most reliable authorities obtainable, and from which the following facts have been elicited:

"That water gas, such as is furnished by the Consumers' Gas Company of Toronto, is produced by passing steam over and through anthracite coal with an admixture of crude coal oil gas, and as the steam is decomposed by the ignited carbon, the hydrogen is set free, and carbonic oxide is produced to a most dangerous extent.

"The following is an analysis by Prof. Henry Morton, of the Stevens Institute of Technology, Hoboken, New York, of water gas furnished by the Municipal Gas Company of New York during the summer of 1877:

Constituents.	Per cent. in Volume.
Carbonic acid	.21
Oxygen	.14
Olefiant gas and like illuminants	15.12
Benzine vapors and like illuminants	1.14
Carbonic oxide	26.18
Hydrogen	27.29
Marsh gas	25.43
Nitrogen	4.45
	99.96

"The amount of carbonic oxide here shown, viz., 26 per cent., renders this gas very dangerous in case of leakage or escape. To sum up in a few words, it seems that as far as a weight of authority goes, carbonic oxide stands condemned as a rank poison, very exceptionally dangerous as compared with the constituents of the other illuminating gas.

"The following is an analysis of the constituents of ordinary coal gas:

Constituents.	Per cent. in Volume.
Carbonic acid	1.953
Oxygen	.139
Olefines	5.504
Carbonic oxide	4.167
Hydrogen	45.847
Marsh gas	40.948
Nitrogen	1.445
	100.000

"The use of water gas was forbidden in Paris on account of the large amount of carbonic oxide which it contained. A commission of eminent chemists reported that it would be dangerous to introduce it even by way of experiment.

"By a law which passed the New Jersey Legislature in 1877, no gas is allowed to be sold in that State which contains more than two per cent. of carbonic oxide. In explanation of this it may be said that carbonic oxide is a gas of so poisonous a character that one volume of it diffused through one hundred volumes of air renders the latter unfit to sustain life. It is said by the commissioners to be a pure physiological poison, producing death as readily when diluted as when pure.

"An act passed by the Legislature of Massachusetts during the session of 1880 enacts 'that the gas shall be tested for illuminating power by means of a disc-photometer, and during such test shall be burned from the burner best adapted to it, which is at the same time suitable for domestic use, and at as near the rate of five feet per hour as is practicable. Whenever the gas of a company shall be found on three consecutive inspections to give less light than fifteen standard English candles, or to contain more than twenty grains of sulphur, or ten grains of ammonia, per 100 cubic feet of gas, or more than ten per cent. of carbonic oxide, or any sulphuretted hydrogen, a fine of $100 shall be paid by such company to the city or town supplied by it.'

"Towne's Chemistry, Philadelphia, 1869, page 168, under Carbonic Oxide, says:—'It is colorless, has very little odor, and is extremely poisonous.'

"Murray's Chemistry, Edinburgh, vol. 1, p. 546, under Carbonic Oxide, says:—'It is fatal to life when inhaled.'

"Reisigs Munich's handbook on coal and water gas, page 59, says:—'This latter gas in particular is dangerous on account of its large contents of carbonic oxide.'

"Cook's Chemical Philosophy, Cambridge, 1875, page 462, under Carbonic Oxide, says:—'The gas is devoid of odor or taste, and is very poisonous, etc.'

"Webster defines carbonic oxide, 'A compound of carbon and oxygen. It is fatal to human life.'

"Appleton's Encyclopedia says:—Carbonic oxide, or oxide of carbon, is a colorless gas, without smell or taste, but more irrespirable and poisonous than carbonic acid. Its inhalation causes immediate asphyxia.'

"The number of deaths which have occurred in Toronto from gas escapes since the introduction of the present article by the Consumers' Gas Company ought to be a sufficient reason for prohibiting the sale of such gas for domestic use, it being of too dangerous a nature to be trusted where an escape, whether from accident, mistake, or any other cause, may occur, the result of which proves so fatal.

"As to the illuminating qualities of said gas, your Committee have had, each and individually, ample evidence and experience of the complaints about poor gas, both in and out of doors, in every district of the city. In fact, the managers of the Gas Company acknowledge its imperfections by advertising to change burners for consumers free of expense. They blame the lava-tipped burners as being the cause of the trouble, when every gas engineer of experience will readily testify that the lava burners rank as the most serviceable in use for good gas. And they cooly ask consumers to use 5-foot burners in their houses instead of 3-foot, when. with good coal gas, the 3-foot burner gave sufficient light for ordinary purposes. If a 5-foot burner is necessary to produce as much light with this gas as a 3-foot burner gives off with good gas, it simply means that gas meters will show two-fifths more gas consumed, and to be paid for. For example, a house that pays say $15 per quarter when using 3-foot burners, will be called upon to pay $25 per quarter when using 5-foot burners, having, of course, consumed two-fifths more gas, and had the manager of the gas company, when recommending 5-foot burners to private consumers, have put them on the street lamps, the citizens might have been spared the present exemplification of darkness visible on so many streets in the city.

Some hints have been given that if the gas company have to go back to the system of making good coal gas, it will have the effect of the consumers being charged an advanced rate. But your committee contend that the consumers were not consulted about the expense incurred in changing the mode of gas manufacture, therefore the gas company should pay for their experiments themselves; and although the managers may have the right to experiment and 'try to turn cents into dollars,' for their company's own benefit, your committee question the gas company's right to jeopardize the rights and interests of the consumers. As, for instance, if the present gas carries with it so much tar or other heavy substances that it necessitates the blowing through the main pipes to large consumers once a week, it certainly must, although perhaps to a less extent, be clogging up the pipes and fixtures throughout the consumers' premises."

[From the Toronto "Mail," Dec. 15.]

CONSUMERS' GAS COMPANY'S OFFICE,
TORONTO, December 14, 1880.

To the Editor of the *Mail*:

SIR—The President, Vice-President, and I were much surprised to read under the heading of an article in to-day's *Mail* entitled "Alleged Poisonous Gas," a report of the Special Committee of the City Council on gas, as

a positive promise has been make by Ald. Walker, the Chairman of that Committee, that no report of the Committee would be published or printed until the matter was discussed more fully and the gas company afforded an opportunity of defending themselves against the charges made and to be made at a meeting to be called hereafter. Aldermen Love, Adamson, and Trees all disclaim having had anything to do with the publication of the report, and were much chagrined and surprised at its having been printed, and until this morning none of them were aware of its contents. It was undoubtedly handed to the reporters by Ald. Walker's authority.

The fact is that what has been published is not a report of the Committee at all, but simply a series of unauthorized statements apparently taken from a report prepared by Mr. T. Littlehales, manager of the Hamilton Gas Company, with whom the chairman stated he had been in correspondence. It is very remarkable that printograph copies of this so-called report of the decisions and conclusions of this committee had been made before the committee met, and before the representatives of the gas company had been heard. Ald. Walker could with difficulty be got to formulate any charges against the company, and when induced to make a specific one seemed very much disinclined to hear the defence made by its representatives, and attempted several times to cut it short. He seemed very desirous to hurry the proceedings through to a rapid conclusion, and would have done so sooner than he did were it not for the remonstrances of other members of the committee. As it was, the meeting was closed when only a portion of the evidence in refutation of the charge made was given.

As the "report" published is unauthorized, and is, in fact, no report at all, it will not be necessary for me to reply to its many false and misleading statements. As to the gentleman from whom Ald. Walker has received his information, it may be only necessary to say that some years since he was an unsuccessful applicant for the managership of this company. His unsolicited letter giving his opinion regarding the gas manufactured by this company, and containing statements at variance with fact, read at the first meeting of this committee by Ald. Walker, and published in some of the daily papers on November 25, concludes with the following paragraph: "I do not wish my name to be mentioned unless I were formally called upon, in which case I can give the company some hard rubs." He has since, as desired, been "called upon" by Ald. Walker, and I leave it with the public to divine the motives which have actuated him in seeking for this call. It is to be regretted that while you have printed the so-called report in full, you have omitted giving the statements made by me in defence of the gas, which included a number of favorable reports from eminent and well-known scientists.

Yours, etc.,

W. H. Pearson,
Secretary.

To the Editor of the *Mail:*

Sir—The Secretary of the Gas Company stated at the meeting reported in your to-day's issue "We had no trouble with the gas in the warm weather, but only since the cold commenced." He stated this in the presence and hearing, and with the approval of the President of the Gas Company. I am sorry to have to draw attention to facts which prove these officials to have memories as defective in retaining as their gas is in lighting power. In August last I made complaints of the gas supplied my house. The secretary most courteously sent up an expert to examine the cause, who changed the burner and did what he deemed necessary to insure a good light. But the flames were still small and dull. I then employed a plumber to see what could be done to get me a light to read by; he came, he saw, but he did not conquer, although he did perform a sort of Cæsarian operation on the pipes. I again applied to the secretary in the heat of August, and again a man was sent, and he blew out of the pipes a viscous, tarry substance. This being removed gave the gas a better chance, and the volume of it was enlarged; but still the lighting quality was and is very poor. Now, all this took place during the "warm weather" which is said to be the happy time during which the gas is not complained of, and I heard both the officials referred to, when I called at the gas office, speak of other complaints of a like kind, and we discussed the difficulty together for some time. But what more severe condemnation can be imagined of gas than that it is all right when not required, and all wrong when alone needed? In warm weather gas is needless, the evenings are so long and light that we prefer the verandah even at dusk to a room heated by the gas burning. What we want is a gas about which their are no complaints in cold weather, on the dark days and dark evenings and mornings of the gas burning season from October to April. Let us have such a gas, and we will not grumble at its being bad in the "warm weather" season.

Now for another piece of evidence, which comes from a distinguished scientific expert. When Dr. Haanel was lecturing on Friday night last he was utterly disconcerted by the deficient lighting power of the gas used in his experiments—gas drawn direct from the mains; indeed, one illustration of extreme beauty and wonderfulness was not given because the gas was so bad. Dr. Haanel said that had he known the quality of Toronto gas he would have brought up a supply from Cobourg. He also informed me technically what the defect arose from, and his remark, based upon a very slight observation, tallies with the chemical analysis given in to-day's paper.

The workmen of the gas company know that the gas is unfit for use. One of them said a few days ago, alluding to the new method of making gas, that "they tried this dodge on in England some time ago, but the public there would not stand it." The public in Toronto seem to me to stand anything done by a rich corporation; their lack of independent spirit is a marvel. The gas officials are on the wrong track. They are trying to play upon the known pusillanimity of the citizens, their customers. They are so hedged in by the breastworks of their wealth and monopoly that they seem to defy any attack and scorn any criticism. Their excessive confidence may be overdone; their charter was made by the people, and the people may cancel it if they so determine. A belief is very generally entertained that a searching investigation into the finances of the gas company would disclose evidence of that charter having been violated. That there is a large cash "rest" in the bank of which the President is also President is not a secret, and those conversant with gas company management know well that gas can be sold here at a profit of 10 per cent. on the capital employed with prices below what are being charged here. But a business so sure of steady returns as a gas company has no right to a monopoly of supplying a necessity of life like gas is, based on such terms as insure so very large a percentage. The course now being pursued by the officials of the gas company is suicidal; they would do well to act on ordinary business principles and forget their monopoly. They make gas to sell to buyers; that is their trade, and common sense dictates that they will do wisely to make the article satisfactory to their consumers. A company in England tried some years ago the same policy that Mr. Austin seems to be directing—that is, reducing the quality of the gas in order to enrich the company beyond the usual degree. The public bore the nuisance a very short time, and the result was such steps being taken as very seriously damaged the shareholders' property in the company so perversely managed.

The shareholders of the Toronto Company are unconscious of danger; they are asleep in the security of their monopoly; but unless their affairs are brought more in harmony with the public interest, unless the customers of the company are supplied with a satisfactory article at a fair price, they will have a very unpleasant awakening some day, and too late will witness their stock fall very seriously in value.

Yours, etc.,

Toronto, Dec. 14, 1880. John Hague.

[From the Toronto "Mail," Dec. 18.]

REPORT OF SPECIAL COMMITTEE ON DEC. 17.—REPORT RECENTLY PUBLISHED.

A report of the Special Committee appointed to investigate into and report upon the character of the gas at present supplied to the city was held yesterday afternoon, Ald. Walker presiding. The members present were—Messrs. Crocker, Love, Adamson, and Trees.

Attention was drawn to the report which was published after the last meeting of the committee, several members holding that the report should not have been published before its adoption.

The Chairman—Mr. Pearson, Secretary of the company, has a letter in the *Mail* and *Globe* newspapers which reflected strongly on myself; but he is in error when he says I gave a positive promise that the report should not be published. He certainly requested me not to do so, but I told him at the time that we had no control of the press. Of course, he wished the matter should be suppressed; he did not wish the public to get such information as was contained in the report, but I consider the public had a perfect right to get all the information possible in a matter in which they are so much interested. Mr. Pearson again forgets that I am acting in an official capacity, like other members of this committee, and that by a resolution of the committee Mr. Littlehales was asked to make a report, which report I would much desire to have printed. Mr. Pearson and the public would then see how rash he had been in jumping at false conclusions, by asserting that I had taken my information from Mr. Littlehales' report. That the publication of our inquiries has done good already is very observable by the much improved state of the gas during the last two nights. Gas tests made at the Government Inspector's office on Wednesday evening showed a much better quality than had been produced for some time previous, and it is reported that the gas company are actually using a good article of cannel coal these last two days.

Ald. Love suggested that Mr. Pearson should be present to defend the company's gas before a report was adopted for presentation to the Council.

The Chairman said that if Mr. Pearson were again allowed to attend, an expert should be present to answer him. At any rate, he did not think any harm had been done by the publication of the report, because it had, in his opinion, resulted in causing the company to improve the character of the gas. In fact, he had become aware of the fact that the company had been

using cannel coal, as he said before, in the production of gas during the past few days. He had observed the great change in the Walker House, and also in the street lamps in front of the hotel.

The Chairman then called upon the Secretary to read at length the communication from Mr. Littlehales, engineer of the gas works at Hamilton. After giving a history of what is known as water gas, the writer said that he was strongly of opinion that it was exceedingly dangerous, and in proof of the statement he pointed to the number of deaths which had occurred from its inhalation in Toronto and elsewhere. In his opinion, however, its character should be determined by chemists.

Ald Love remarked that the Nova Scotia coal was very good for making gas.

The Chairman stated that during all his experience as a hotel keeper for 30 years, he was convinced that the water gas was much more dangerous than coal gas. When he kept the American Hotel he knew of only one family having suffered from the old coal gas; but they were all able to take their breakfast in the morning, and took their departure; and there were no fanlights over the bedroom doors. Recently, at the Walker House, when a prominent lumberman was found in a dying condition, the fanlight over the door was open. From this it would be seen that the water gas was very poisonous.

A letter was read from the City Solicitor, informing the committee of the mode of procedure in case it were its intention, in order to have purer gas, to seek an amendment to the Act from the Dominion Parliament, as the present Act appeared to be altogether in favor of the gas company.

Ald. Love said that the letter just read from Mr. Littlehales was such a lengthy and important document that it would be only just to Mr. Pearson to lay it before him, in order that he might reply to it if he deemed it proper to do so.

The Chairman had observed a very good letter in the *Mail* from Mr. Hague on the gas question, but Mr. Pearson had not yet replied to it.

Mr. Love—No doubt he will do so. He wanted to know what course the committee intended to pursue—whether a chemical test should be made or not.

The Chairman was under the impression that there was enough of evidence already before the committee to enable it to make a report for presentation to the city. The company had admitted that it was using the water gas, and that it was frequently compelled to blow out the mains in order to clean them.

Ald. Trees suggested that all the letters read should be put in as evidence brought before the committee, and then have them all submitted to Mr. Pearson for an answer thereto, and this was agreed to.

Ald. Love thought the Council ought to ask the Dominion to amend the Gas Act, so as to improve its quality.

Mr. McWlliams stated that Mayor Beaty, if requested by the Council, could introduce a bill, and then the Government would take charge of it. In such an event it would become a public bill, and its cost would consequently be borne by the Government.

This was also agreed to, and the Committee adjourned.

The Calorific Energy of Water Gas.

Reply of Gen. Haupt to Prof. Morton.

A copy of the American Gas Light Journal, of March 2d, 1880, was sent to me at Washington last Spring, and received by me on the day of my departure from that city. It was laid aside for examination on my return; but as I did not return for some months, the article was not read until recently when a careful perusal was given it on the cars between Washington and Philadelphia.

This explanation will account for the delay in presenting a reply to a paper which, greatly to my surprise, charges me with an "ingenious attack upon that palladium of modern science, the doctrine of the conservatism of energy," and with being an advocate of the old fallacy of perpetual motion.

It might be a sufficient answer to refer the *intelligent* reader to the paper which is so severely criticised, and permit him to decide whether the conclusions are legitimate deductions from the positions there taken; but there may be many of the readers of the Journal who will not trouble themselves with such examination, and who may have received erroneous impressions from the article in question which is well calculated, if not intended, to divert attention from the real points at issue.

The object of my paper was to demonstrate that an increase of energy resulted from the production of water gas, in defence of the systems of gas production controlled by the Hydrogen Company of the United States, and in opposition to the position of a writer who attempted to show that a waste of energy attended the production of gas from water.

Professor Morton does not apparently deny that a gaseous fuel possesses a higher actual calorific power than solid carbon, although, a superficial reader might possibly draw this inference; but, if denied, the denial would be useless in the face of facts known and accepted by metallurgists in all countries. Even the Siemens gas, in the opinion of Pittsburg manufacturers, effecting a saving of two-thirds of the fuel as compared with coal.

It had been urged as an argument against gaseous fuel that the energy of reunion of dissociated elements could not exceed the energy expended in effecting the dissociation.

This I conceded fully, although Professor Morton characterizes my concession as a rather halting admission of the truth of conservatism; but an admission of this truth, even though characterized as halting, is not a denial of it, and cannot be charged, with any consistency, as "an attack upon the palladium."

What I did claim was that where was no reunion of the elements that had been dissociated; but when each of the separated elements formed new combinations with other elements, there might be developed an increase of energy from the sum total of the two combinations.

In other words, if A and B are two elements which require a certain calorific energy for dissociation, their subsequent reunion cannot increase the amount of this energy; but if A unites with a new element C, and B with another D, the two combinations may develop an increased energy.

This is the position which Prof. Morton seems to consider as "an attack on the palladium of modern science," and yet he kindly furnishes an illustration in explanation of its truths. He says: "Take for example the compound chloride of zinc. To decompose one pound of this we should need 1.529 French heat units. This would give us half a pound each of zinc and chlorine. If now we combine the zinc with oxygen it would yield 650 units, and if we combine the chlorine with hydrogen it would yield 11.891 units, or together 12.541 units."

But the professor remarks: "The case of water gas has no analogy whatever with such instances as were suggested before," and then proceeds: "In the case of water gas the bodies used are carbon and water, of which the carbon is the sole source of energy, and at the end of the process the water is returned to its original state, and the only body changed is the carbon, which is converted into carbonic acid, exactly as if it had simply been burned. Suppose we start with a pound of carbon and a pound and a half of water in each instance, and in the first case burn the carbon in the air, allowing the water simply to look on. The pound of carbon will take gratis 2⅔ pounds of oxygen from the air and will produce 3⅔ pounds of carbonic acid, which, with the 1½ pounds of observant water, will be on hand at the end of the operation."

"In the second case, suppose that we put the 1 pound of carbon and 1½ pounds of water into a retort, and by the aid of a good hot fire supplied by other fuel outside convert them into theoretical water gas, half carbonic oxide and half hydrogen, and then burn these in the freshly supplied air, we shall have 2½ pounds of carbonic oxide, which will take 1½ pounds of oxygen from the complacent air and give us 3⅔ pounds of carbonic acid, as before. The hydrogen, of which there will be ⅓ of a pound, will take 1⅓ pounds of oxygen from the air to form again 1½ pounds of water. So that, as the result of this operation also, we have 3⅔ pounds of carbonic acid and 1½ pounds of water."

Well, what does this illustration teach? Did any one deny that the *products of combustion* would be the same in the two cases? I certainly did not; the question under consideration was the developement of calorific power. Will the professor assert that this is the same in both cases? This would be a fair inference from his illustration—let us see.

One pound of carbon burned in air develops 14.500 units, but one pound of carbon in water gas burned in air developes over 20.000 units.

Of course it requires an expenditure of calorific energy to produce the water gas, all of which was taken into account.

"The pound of carbon in the retort" was not forgotten, its calorific power in combustion was compared with the calorific power of the gases produced from it.

The fact to which I desired to give prominence was that a given weight of carbon in water gas developed a greater number of units in combustion than the same weight of carbon burned in air. Prof. Morton says: "Gen. Haupt correctly suggests that this reaction takes place at a proper temperature, and in the previous example he shows that for this proper temperature some 8.964 units are needed."

If this admission was made in the preceding example there could have been no necessity for repeating it; the remarks in reference to producing gas in a cold retort were therefore uncalled for. The statement was intended simply to impress the fact, which seemed to be doubted by some, that the combustion of water gas would develop more calorific power than the carbon which entered into its composition. The amount of fuel required was stated elsewhere.

I do not claim that theoretically a greater calorific power can be obtained from water gas than from the fuel, inside and outside of the retorts which produce it, but I do claim that practically there is a vast increase in the proportion utilized.

It is conceded that in metallurgical operations requiring high temperatures, less than 2 per cent. of the calorific power of the coal can be utilized, and the data furnished by Pittsburgh manufacturers showed the proportion utilized to be 2, 2½ and 3 per cent. in different establishments, while the efficiency of natural gas as compared with coal was from 10 to 20 times as great and Siemens gas three times as great as the coal from which it was produced.

I may not have been sufficiently careful in drawing the line of distinction between theoretical and practical results, but the paper taken as a whole was, I think, sufficiently explicit to avoid misunderstanding as to its meaning.

Prof. Morton observes that in practice the best results show that at least 5 pounds of coal, or equivalent fuel, must be burned outside the retort for every pound treated inside.

If this be true, then the Gill system must exhibit very superior economy, as only 25 pounds of fuel are required in the furnace to 20 pounds in the retort, or 5 to 4 instead of 5 to 1, as above stated.

Prof. Morton observes in conclusion that their convenience of application may, and in certain cases does give combustible gases a great economic value, and that this conclusion is fully sustained by my paper.

The great economic value does not result simply from convenience of application, but mainly from the vastly increased proportion of the calorific energy that can be utilized.

Fuel, as I have elsewhere stated, is not burned simply for the purpose of wasting it, and when considered in connection with the work done the advantages of gaseous fuel, and especially of hydrogen, over solid carbon became conspicuous, not only in the quantity of calorific energy developed, but also in intensity of combustion.

Very extravagant claims are made by the advocates of processes of gas manufacture, the fallacy of which can be readily shown.

It requires 16¾ pounds of pure carbon and 25 pounds of water to produce 1,000 cubic feet of theoretically pure water gas, and consequently less than 20 pounds of ordinary coal cannot, after allowance for ash and waste be regarded as sufficient.

It requires 25 pounds of coal nearly to heat the materials in the retorts or cupolas.

To this must be added the fuel required in the furnace to supply losses by radiation and flues, which in an ordinary bench of retorts is, from observations by the writer, 17½ pounds.

It does not seem possible, therefore, that under any usual system, using a cold blast, that 1,000 cubic feet of gas can be produced with less than 62½ pounds of coal with any cupola or furnace system acting intermittently, it would seem that the losses by radiation and flues must be considerably greater than with retorts.

H. Haupt, C. E.

115 Broadway, N. Y.

Dr. Siemens's Gas Fire.

In a recent number we commented on the letter of Dr. Siemens to *The Times*, wherein he described the particular kind of gas and coke fire which he has adopted for his own private use, and recommends as promising, if universally introduced into town houses, a complete deliverance from the smoke nuisance from which London suffers so much. Dr. Siemens's arrangement is as follows :

The essential parts of the permanent fittings of the grate consist of a copper plate, ¼-inch thick, fixed in the back of the grate and extending about 5 inches above and below the fire-bar level. To this is rivetted an iron dead plate, which covers the bottom of the grate with the exception of the space immediately behind the front bars, to allow for the rising gas flames from perforated gas pipe. The copper back plate is provided, underneath the lead plate, with a frill made of 1-16 inch sheet copper, and in front of this is the angle plate, with trap-door, for removing ashes. The grate is first filled with coke, and the gas from the pipe is then lighted, and the flame impinges on the front of the coke. The flame is not atmospheric, the pipe being merely pierced with holes ¼-inch apart. As the coke becomes heated, it commences to undergo a slow combustion, thus assisting the gas to radiate heat. The copper back plate acquires heat by contact with the coke, and this heat being conducted through the frill heats the air which goes to feed the combustion of the gas and coke, thus increasing the useful effect, at the right point, by the help of heat drawn from the back of the grate, where it would be otherwise wasted. Dr. Siemens states that the result of a day's working of one of these combination fires was the consumption of 62 cubic feet of gas, costing, at 3s. 6d. per 1000 feet, 2.604d.: with 22 lbs. of coke, worth, at 18s. per ton, 2·121d.—together, 4·725d. for nine hours, or 0.524d. per hour. The grate, when consuming coal cost 0·633d. per hour ; thus showing a decided economy in favor of the former system, while it had a better effect in warming the apartment, and was, moreover, thoroughly smokeless. In common with other gas fires, this, of course, possesses the advantage of being always ready for use at a moment's notice, giving no trouble, and being very cleanly. If a less expensive arrangement than the above is desired, a simple close-fitting ash-pan can be made to cover the fire bars of an ordinary grate, and the gas pipe laid in front of it, as before described. This ash-pan needs emptying only at intervals of several days, and the device works well ; but the appearance of the fire is not so brilliant as when the hot air arrangement is added. Dr. Siemens considers the use of raw coal in fires almost barbarous, and believes that the time will come when all fuel will be divided into its two constituents, solid and gaseous, before reaching the factory furnace or the domestic hearth.—*Journal of Gas Lighting.*

Correspondence

[The Journal is not responsible for the opinions expressed by correspondents.]

Corrections by Mr. Pearson.

Consumers' Gas Company,
Toronto, Ont., Dec. 31, 1880.

To the Editor of American Gas Light Journal :—

Dear Sir—In the discussion which took place on my paper on the Lowe Process here, at the last meeting of the American Gas Light Association, Mr. Littlehales, of Hamilton, asserted that he had seen the Lowe gas made here when it was less than 10 candles, and in proof read a paragraph from a Toronto paper. That paragraph as read by him, and a portion of the discussion which followed I give below :

"Mr. Littlehales—Mr. Pearson challenges my statement about the quality of the gas. I read from a Toronto paper: 'Alderman Bonstead presented four reports from the Government Inspector in reference to the gas supplied to the city by the Toronto Gas Company, They showed the illuminating power of the gas (12 candles being the standard) to have been, on October 5th, 12.08 candles ; on October 19th, 10.62 candles ; on October 25th, 14.67 ; on October 30th, 11.54.'

"Mr. Pearson—That is manifestly incorrect.

"Mr. Littlehales—That was last October."

And again, a little further on—

"Mr. Littlehales—But you said you commenced the Lowe process in February, 1879, and this is October, 1879."

I felt confident at the time that the statement was incorrect, as I knew the gas had never in 1879 been of so low a candle power ; but in the face of a report which Mr. Littlehales so positively said was for October, 1879, I could then say nothing more.

On my return home I found the report read in my scrap-book, but instead of being for October, 1879, it was for October, 1876. I also verified this by inquiring at the Inspector's office. This was years before we commenced making gas by the Lowe process. Mr. Bonstead, who presented the report as chairman of the Gas Committee, has not been a member of the City Council since 1878, and chairman of the committee since 1876.

In your admirable and generally most accurate report, I find one statement that I made reported incorrectly—that of a case of gas suffocation which took place here at a hotel. Instead, as it is stated, of the man having inhaled the gas "from half-past twelve until half-past five in the morning," he inhaled it from between six and seven in the evening until half-past five in the morning, the gas escaping from between six and seven in the evening until half-past twelve, when it was turned off at the stop-cock.

Respectfully yours,
W. H. Pearson.

Price of Gas on an Illuminating Basis.

New York, Jan. 12th, 1881.

Mr. Editor : In reply to your correspondent in the last Journal, I would submit the following. The value of the gas must be in proportion to its illuminating power according to the theories now generally accepted ; if this is so the equivalents in value would be as follows. Of course, the incidental advantages of more perfect combustion of the cheaper gas are not taken into account—

11½	candle gas	@	$1.75	per M.,	will be equivalent to a	21	c'dle gas	@ $3.50
12	"	"	2.00	"	" "	21	"	3.50
13	"	"	2.16	"	" "	21	"	3.50
14	"	"	2.33	"	" "	21	"	3.50
15	"	"	2.50	"	" "	21	"	3.50
16	"	"	2.66	"	" "	21	"	3.50
17	"	"	2.83	"	" "	21	"	3.50
18	"	"	3.00	"	" "	21	"	3.50
19	"	"	3.16	"	" "	21	"	3.50
20	"	"	3.33	"	" "	21	"	3.50
21	"	"	3.50	"	" "	21	"	3.50

For example, if a consumer had to pay $3.50 per thousand for a 21 candle gas, then he should only pay one-half that sum for an 11½ candle gas, because he would have to use 2000 cubic feet of the 11½ candle gas to obtain the same amount of light as that which he would obtain from 1000 cubic feet of the 21 candle gas.

Accordingly, two five feet burners, of 11½ candles each, will be equivalent to one five feet burner of 21 candle power. The two five feet burners will consume 10 cubic feet per hour of the 11½ candle gas, and, together, will give a light equal to 21 candles. The one five foot burner will consume 5 cubic feet of the 21 candle gas per hour, and give a light equal to 21 candles.

Y.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

This is a recognized official organ of—
LIGHT, HEAT, STEAM, WATER-SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE.

TERMS

SUBSCRIPTION—Three Dollars per annum, in advance.

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MONDAY, JAN. 17, 1881.

Official Report of Examinations of Gas for two Weeks ending Jan. 8, 1881, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

1880. Dec.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas Light Co.	Metropolitan Gas-Light Co.	Harlem Gar-Light Co.	Municipal Gas-Light Co.
	*	†	*	†	‡	*	†
27		24.46	20.63	24.06	22.89	19.28	26.15
28	Between	22.62	20.22	25.56	23.25	19.15	24.08
29	9.30 A.M.	20.56	19.42	24.22	23.16	18.86	26.30
30	and	21.19	20.35	25.34	22.95	18.51	26.43
31	1 P. M.	26.02	19.32	23.14	22.68	18.20	26.76
	Average	22.97	19.99	24.46	22.98	18.80	25.94
Jan.							
3		21.13	20.06	23.74	24.04	19.58	21.53
4		21 10	20.06	26.03	23.98	19.47	25.24
5		22.70	19.68	20.31	24.05	19.93	24.90
6		20.26	19.70	24.56	23.95	49.97	25.14
7		21.61	19.75	24.85	23.79	19.64	25.51
8		21.84	20.03	24.43	24.26	19.57	25.39
	Average	21.44	19.88	23 98	24.01	19.69	24.62

* Five foot ava tip with check.
† Bray's slit union, No. 7.
‡ Bray's slit union, No. 6.
E. G. LOVE, Gas Examiner.

Determination of the Fatal Dose of Carbon Oxide for Various Animals.—M. Gréhant.—Air containing 1-300th of its volume of carbon oxide proved fatal to a dog when inhaled for fifty minutes. With another dog of the same size the fatal dose was 1-250th. A rabbit resisted various proportions up to 1-60th. A sparrow perished with 1-500th.—*Comptes Rendus.*

Accidents From Gas.

A HARTFORD GIRL'S TERRIBLE DEATH AT AN INSANE ASYLUM.

Mr. Editor:—I inclose a notice of the first installment of death and suffering from water gas at Middletown, Conn. The water gas was introduced into the Asylum last September. X.

MIDDLETOWN, Monday, Dec. 27, 1880.

Saturday night two servant girls, named Kate Hastie and Katie Coleman, employed at the Connecticut Hospital for the Insane, went to bed about 10 o'clock, leaving the gas burning, but turned down. In the morning, not being up to attend to their duties, some of the other girls went to their room, but found it locked. An entrance was made to the room by a window, when it was found that Kate Hastie was dead and Katie Coleman just breathing. The hospital physicians were summoned. They went to work energetically to save the life of Katie Coleman, who lay insensible until 4 P.M. Sunday, when she recovered consciousness. She said that she and Kate Hastie went to bed leaving the gas burning. Some time during the night she awoke and heard Kate Hastie breathing hard. She spoke to her, and the girl quieted down. She then went to sleep herself, and that was the last she knew until she came to herself Sunday afternoon. The gas went out from some cause unknown. The Hastie girl belongs in Hartford, and her remains were taken there this forenoon for interment.—*Hartford Evening Post.*

SUFFOCATED BY GAS.

Patrick Nolan, a bartender, was found dead in his bed at No. 10 First street yesterday morning. By his side, unconscious, lay a woman. The room was filled with gas, and it is supposed that it was blown out by one of the occupants of the room. The woman was taken to Bellevue Hospital, and there she soon died.—*N. Y. Herald*, Jan. 1.

DEATH IN A BOWERY HOTEL.

R. B. Reynolds, a sailor of the United States steamship Powhatan, engaged a room in the Van Dyke House, at No. 28 Bowery, on Sunday night, and retired. Yesterday he was found dead in his bed. A brief investigation showed that he had been asphyxiated. On retiring he had blown out the gas. *N. Y. Herald*, Jan. 4.

AN OIL TANK A DEATH BED.

BRADFORD, PA., Jan. 5.—Matthew Schenler, age 50, went into an oil tank this afternoon to recover an augur-bit, and was overcome by the gas arising from the oil. He was discovered lying dead in the bottom of the tank half an hour later.—*N. Y. Tribune*, Jan. 6.

HE BLEW IT OUT.

Another man has almost fallen a victim by blowing out the gas. Last Monday night there came to Jo. King's Hotel, from the midnight train, John Overbey, son of Peter Overbey, the well-known and prosperous farmer of this county. The young man engaged a room and retired for the night. The next morning Jo. rapped on his door, but receiving no answer, and thinking his guest was in need of rest, as he had come in late the night before, he left without awakening him. However, about 4 o'clock yesterday afternoon the landlord and the young man's father entered the room and found young Overbey lying speechless and unconscious on the bed, black in the face. Dr. Jessup was immediately summoned and after diligent work the patient was restored to consciousness. He then said that he had blown the gas out before retiring Monday night. How the victim managed to exist so long as he did is a profound mystery. He was still confined to his room this morning, but is fast recovering.—Vincennes (Ind.) *Commercial*, Jan. 5.

[The gas in this instance was illuminating gas made from caking coal.—ED.]

EXPLOSION IN A SHOE STORE.

Escaping gas was set on fire by a match in George Fleckenstein's shoe store, at No. 131 Eighth street, yesterday, and exploded. Damage to the amount of $40 was done in the store.—*N. Y. Tribune*, Jan. 6.

ATTEMPTED SUICIDE.

Frederick Healy, an attache of Werfelman & Kohmyer's saloon, No. 391 Bowery, attempted to comm suicide yesterday morning. Going to his room about 2 o'clock he turned on the gas and, stuffin his handkerchief in the keyhole, lay down on his bed. When discovered, some hours later, he was insensible, and was removed to Bellevue Hospital.—*N. Y. Herald*, Jan. 7.

HE DIDN'T TURN OFF THE GAS.

Joseph A. Grant, keeper of a cigar store at No. 1,355 Broadway, went to sleep in a chair on Monday night, leaving the gas turned on and unlit. He was found nearly suffocated yesterday, and was removed to the New York Hospital.—*N. Y. World*, Jan. 12.

AN ARCHITECT who built a new city hall for a western town made a botch of it and fled to Canada, "to remain until the affair should blow over," as he left word with his friends. Next day a high wind struck the town and his friends telegraphed him, "Come back; the whole shebang was blown over last night" *Engineering News.*

Prices of Gas Coal.

The following are the prices at which the companies mentioned are shipping coal:

	New York.	Baltimore.	S. Amboy
Penn.....	$5.25	$4.10	$4.80
Scott's Youghiogheny..	5.00	3.75	
Montauk.....	5.00	3.70	
Newburgh Orrel.....	5.00	3.75	
Tyrconnell	5.00	3.75	
Despard.....	5.00	3.75	
West Fairmount.....	5.00	3.75	

To give some idea of the relative prices at the East and the West we give the following quotations of coal furnished by the Fort Pitt Coal Company:

At Pittsburgh, f.o.b. cars...	$1.80	per ton of	2000 lbs.
At Cleveland, f.o.b. cars....	3.40	"	"
At Buffalo, f.o.b. cars..	3.70	"	"
At Chicago, f.o.b. cars	4.50	"	"
At Indianapolis, f.o.b. cars.	3.75	"	"

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
34 PINE STREET, NEW YORK CITY.
JANUARY 17, 1881.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

Gas Co.'s of N. Y. City.

	Capital.	*Par.*	*Bid.*	*Asked*
Central.....	466,000	50	50	56
Harlem.....	1,800,000	50	60	65
" Bonds	170,000			103
Manhattan.....	4,000,000	50	165	170
Metropolitan.....	2,500,000	100	130	135
" Scrip ...	$1,000,000	...	102	105
Mutual.....	5,000,000	100	60	65

" Bonds, gold	900,000	1000	100	104
Municipal	1,500,000	100	140	150
" Bonds	750,000		106	110
New York	4,000,000	100	90	95
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	102	105
Citizens	1,200,000	20	50	55
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal	1,500,000	100	60	70
Peoples	1,000,000	10	25	26
" Bonds	290,000	...	90	95
" Scrip	250,000	...	75	85
Metropolitan	1,000,000	100	60	63
Nassau	1,000,000	25	47	52
" Ctfs.	700,000	1000	95	100
Williamsburgh	1,000,000	50	57½	63
" Bonds		...	98	103
Kings Co	135,000	100	55	60
" Bonds	40,000	—	—	—
Richmond Co., S. I.	300,000	...	70	75
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	72	76
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	10[illegible]	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.				190
Consolidated, Balt.			84	85
Bonds			109	110
East Boston, Mass		25	114	120
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Hempstead, L. I.	25,000	100	...	—
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150.000	40	117½	
Jersey City	750,000	20	155	140x
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	70	80
Laclede St Louis Mo	1,200,000	100	108	110
Montreal, Canada	2,000,000	100	148	149
New Haven, Conn		25	128	130
Oakland, Cal			34	35
Peoples, Jersey City		...	85	90
" " Bds.				5
Pittsfield, Mass			120	130
Rochester, N. Y.		50	70	80
" Citizens		100	30	35
Rondout & Kingston			75	80
St. Louis Missouri	600 000	50	250	254
San Francisco Gas-Co., S. Fr'isco Cal.			74	75
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C.	1,500,000	20	215	225
" Scrip	500,000	20	150	160
Woonsocket, R. I.	150,000	100	80	...
Wilmington, Del.		50	174	...
Yonkers		50	—	70

200 shares Manhattan Gas, sold at auction, @ 170.

The Metropolitan Gas Co., of Brooklyn, N. Y., have declared their usual semi-annual dividend of 2½ per cent.

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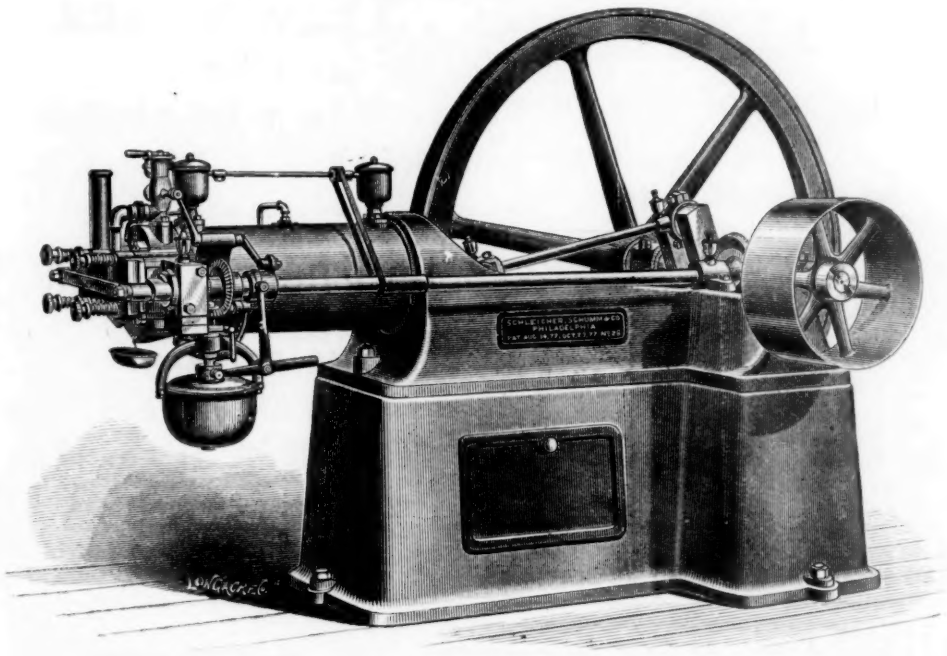

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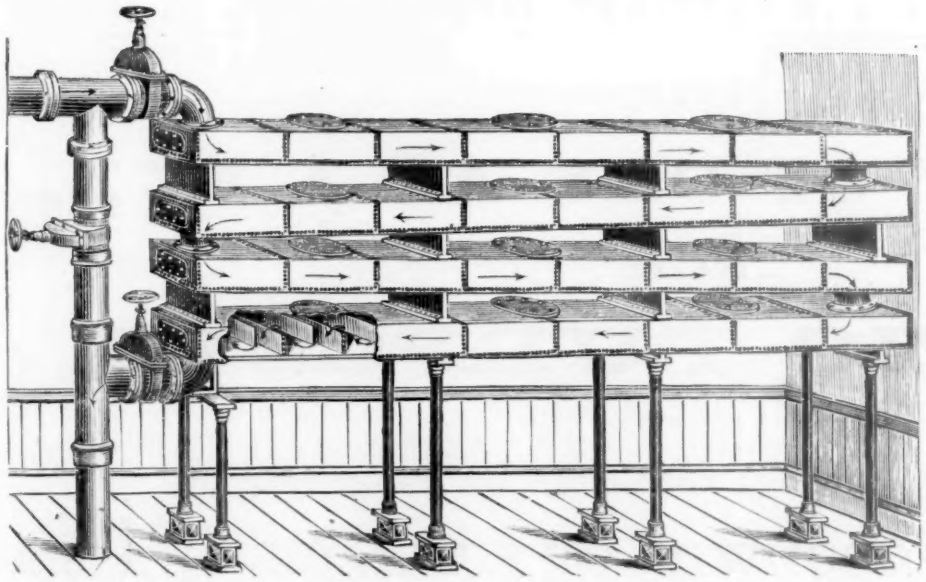

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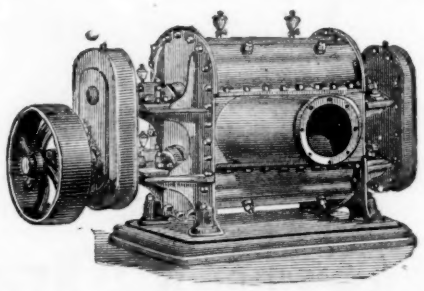

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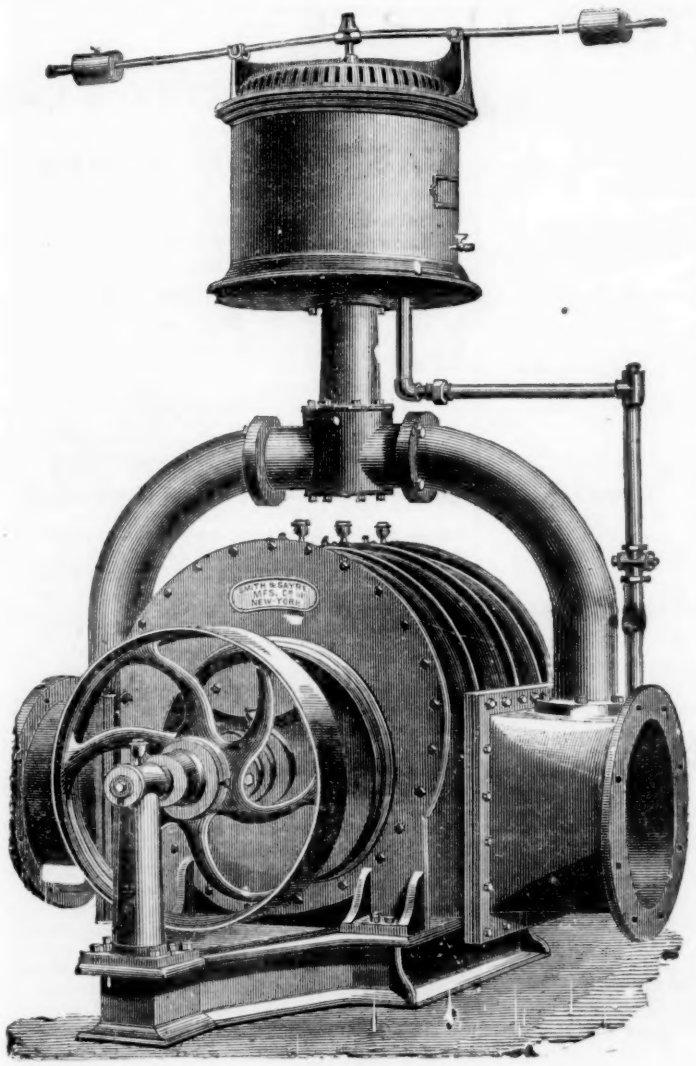

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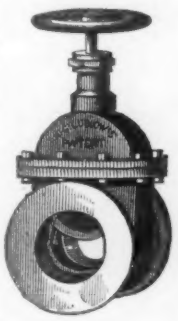

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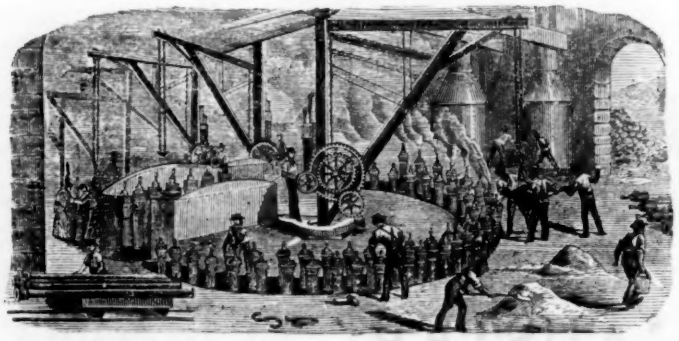

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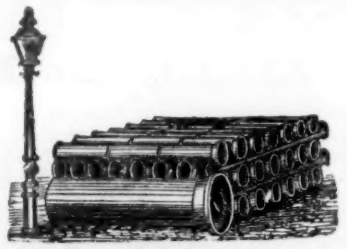

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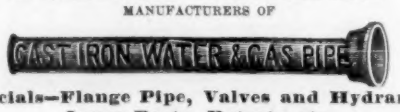

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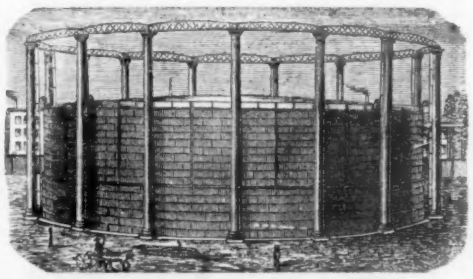

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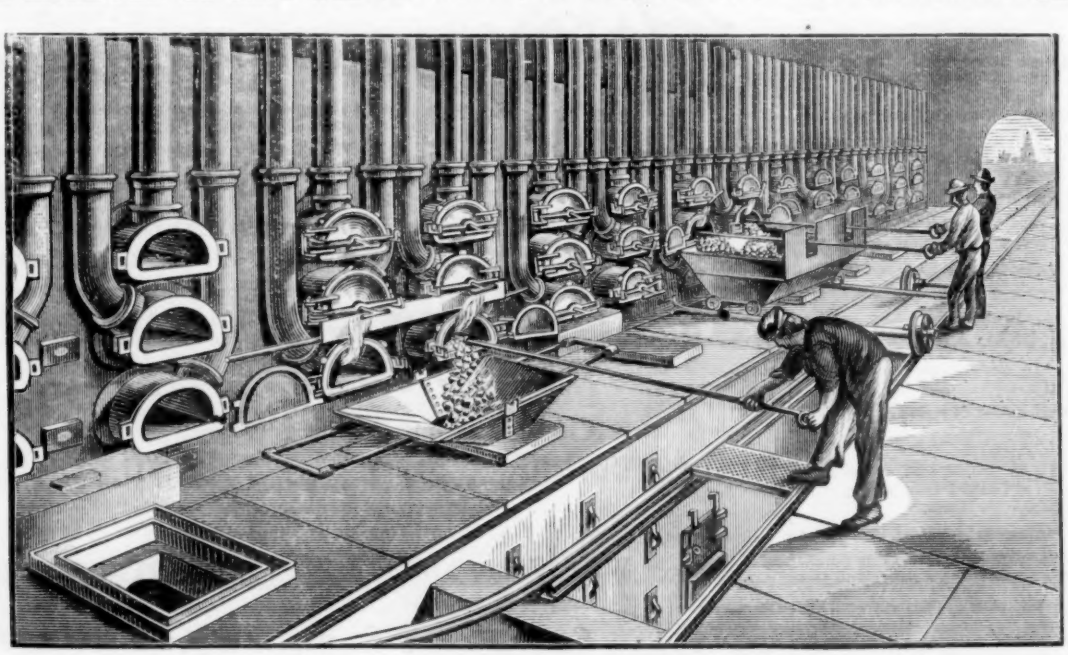

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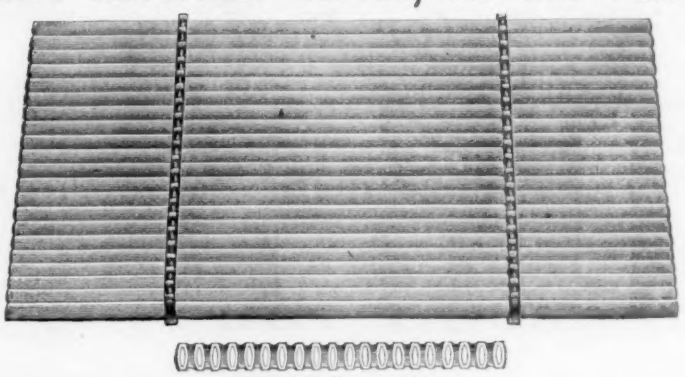

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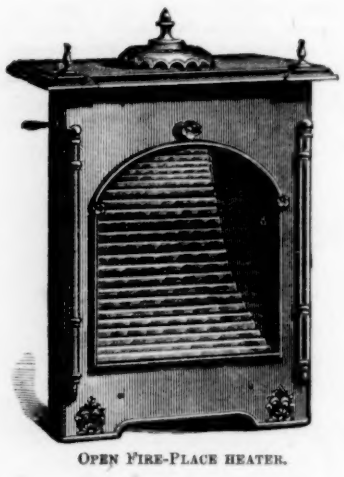

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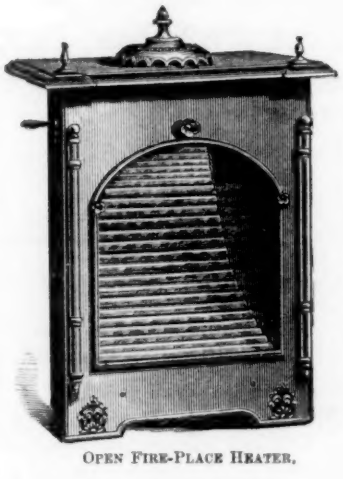

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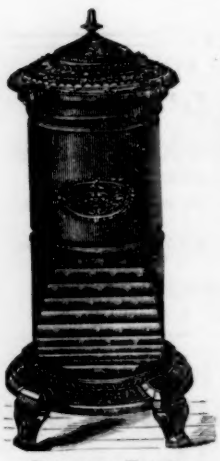

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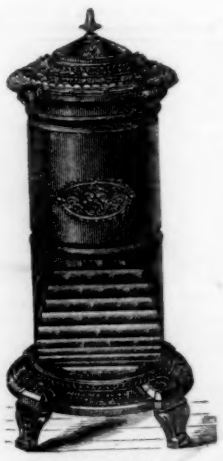

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